DERWENT-TUE-1999

Fig. 1

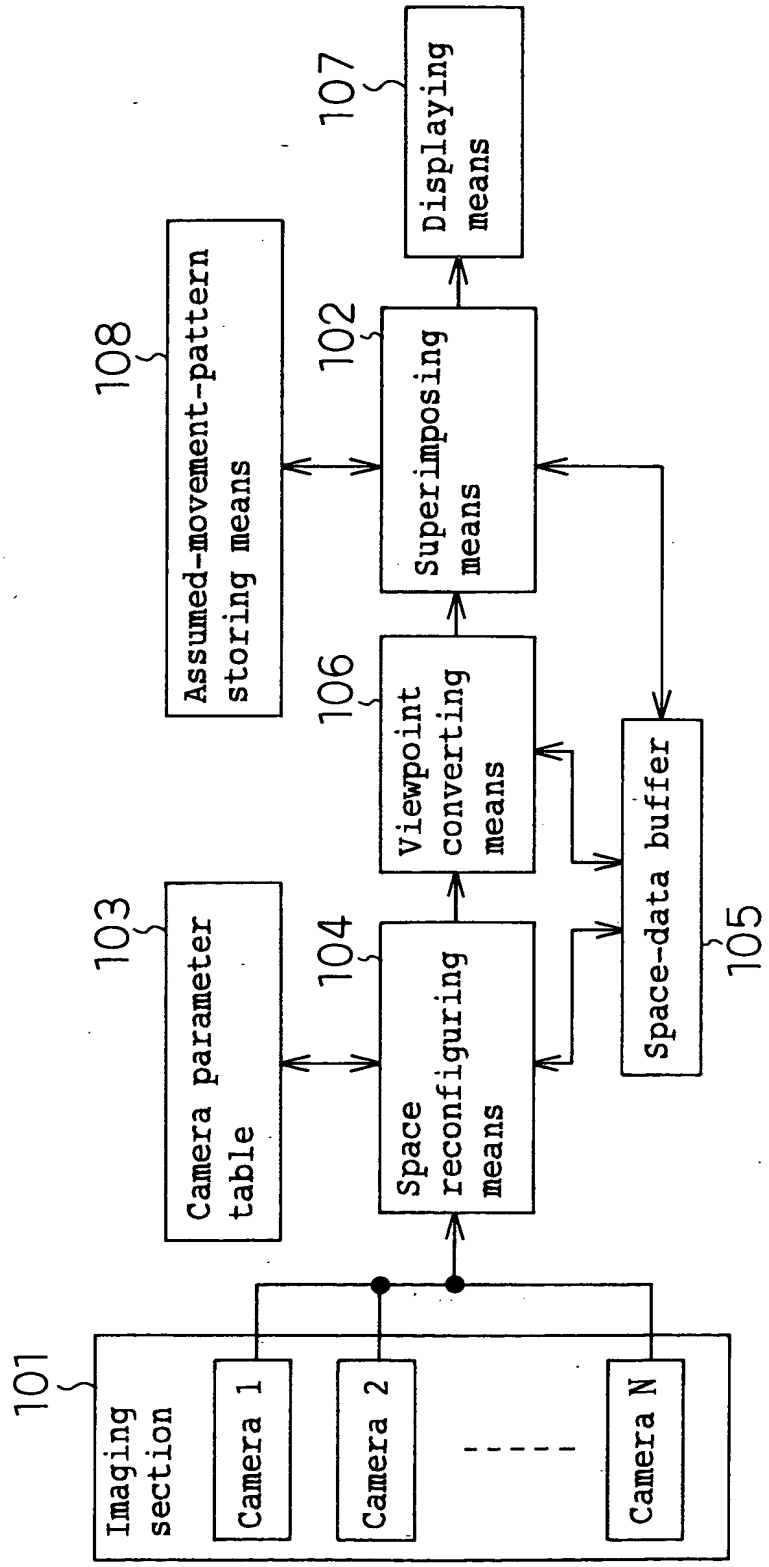


Fig. 2

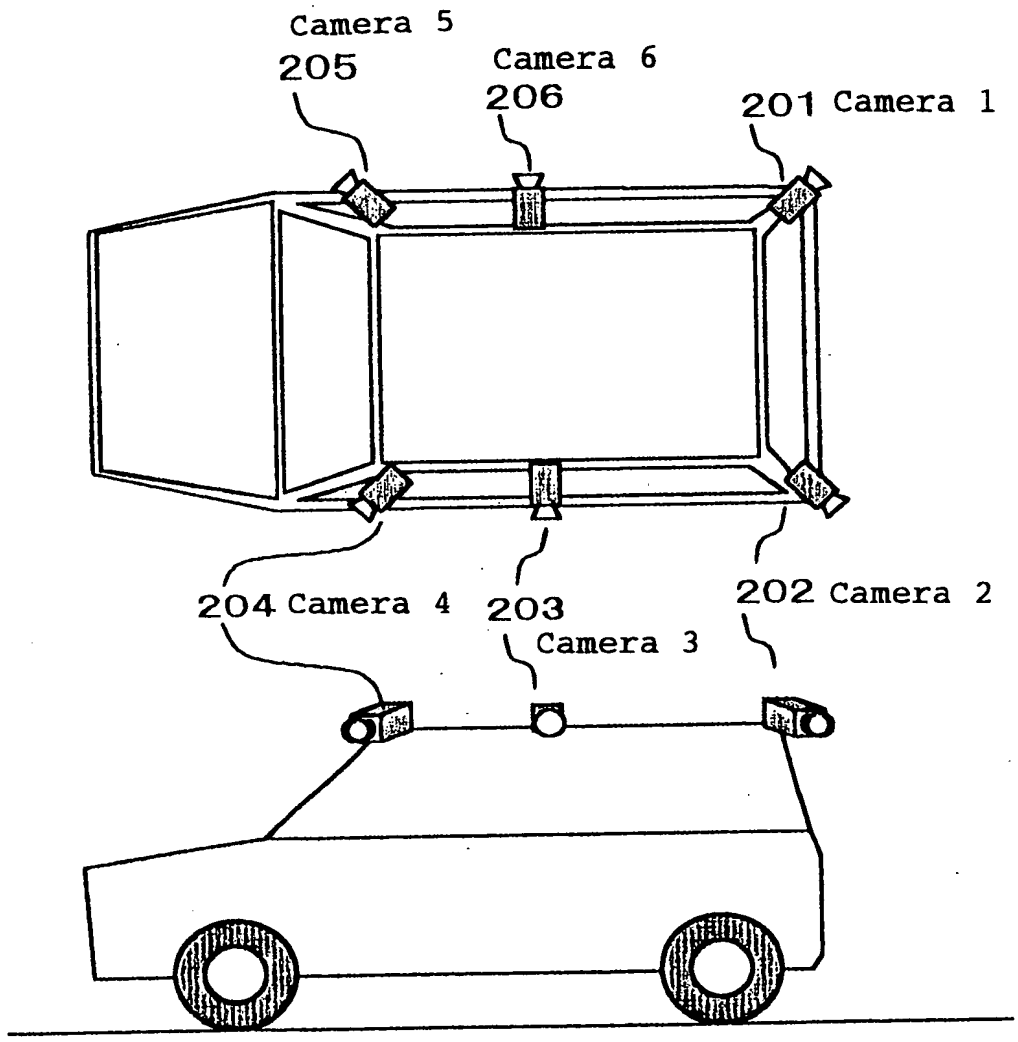

Camera 5
205
Camera 6
206
201 Camera 1
204 Camera 4
203
Camera 3
202 Camera 2

Fig. 3

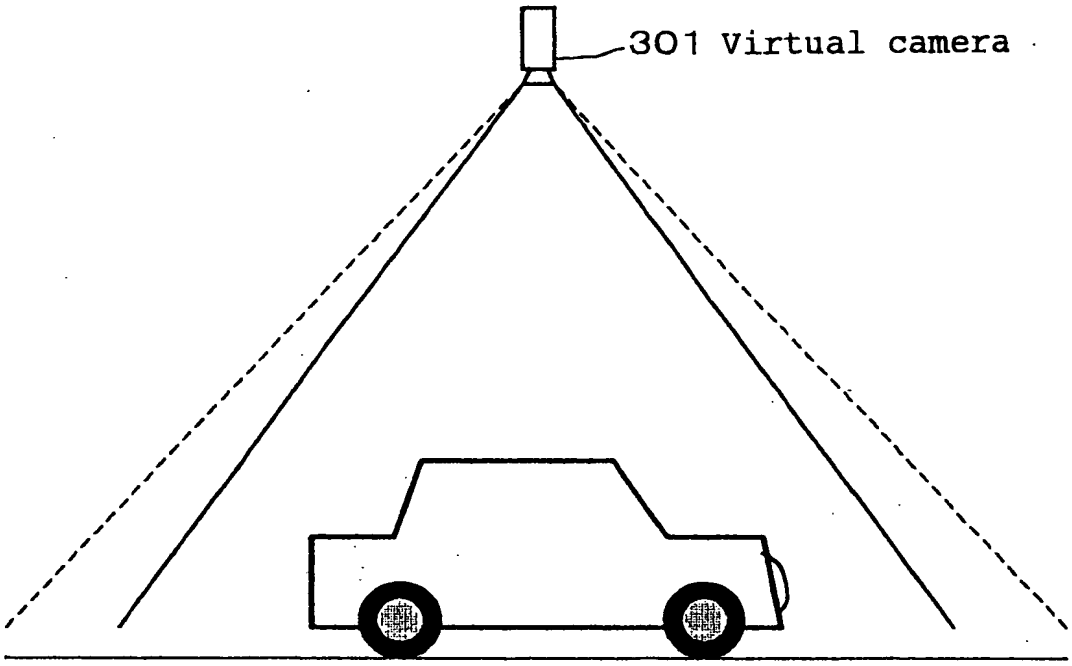


Fig. 4

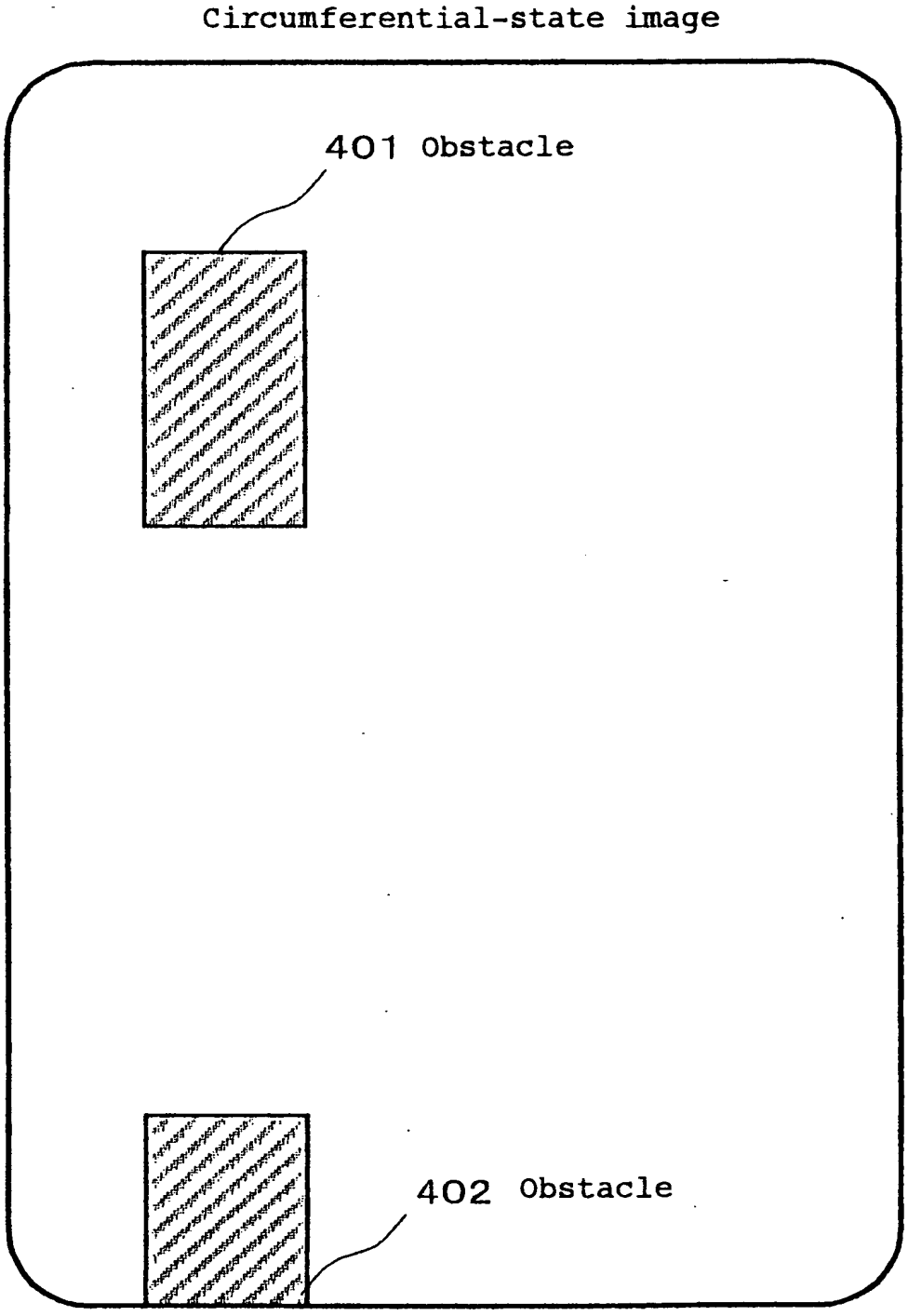


Fig. 5 (a)

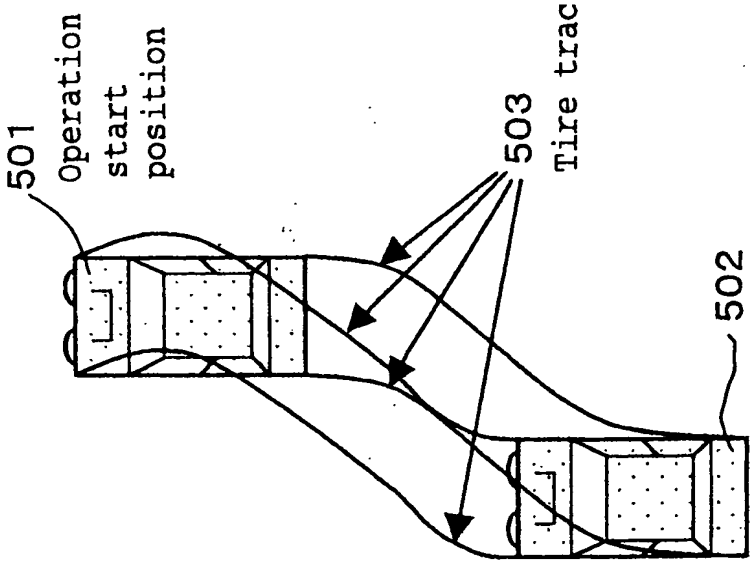


Fig. 5 (b)

Number of revolutions of tire	Steering angle of steering wheel
(Unit: One turn)	(Unit: Degree)
0.25	0
0.25	−45
0.25	−90
0.2	−135
0.1	−180
0.2	−135
0.25	−90
0.25	−45
0.8	0
0.25	45
0.25	90
0.2	135
0.1	180
0.2	135
0.25	90
0.25	45
0.25	30
0.25	15
0.5	5
0.5	0

0027 P00 T00 E3560

Fig. 6 (a)

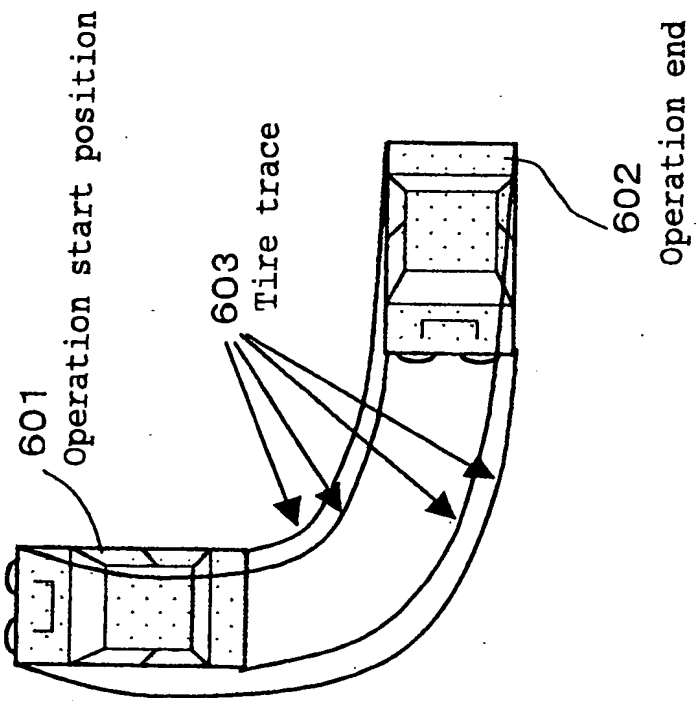
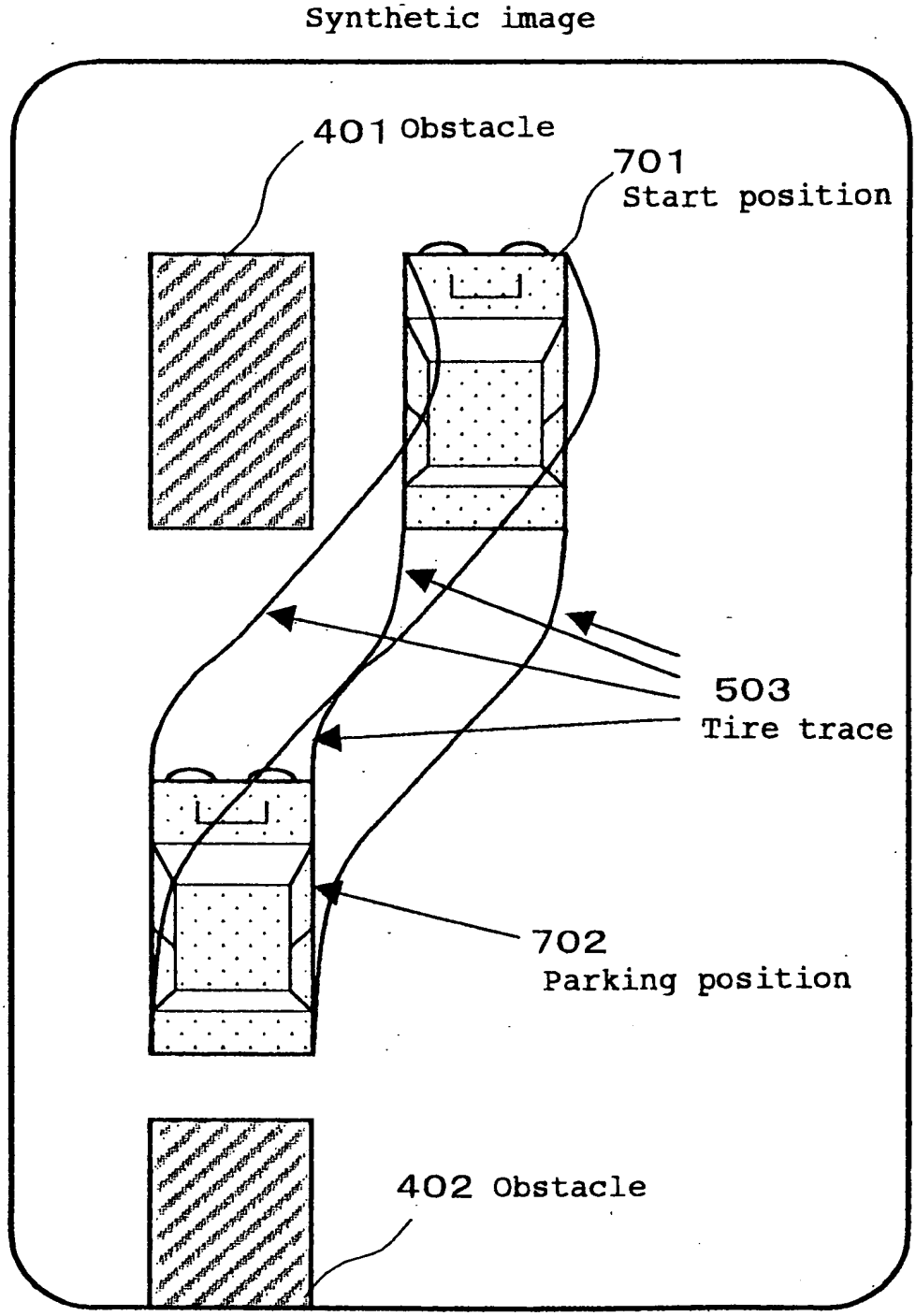


Fig. 6 (b)

Number of revolutions of tire (Unit: One turn)	Steering angle of steering wheel (Unit: Degree)
0.2	0
0.25	45
0.25	90
0.2	135
0.1	180
0.2	135
0.25	90
0.25	45
0.25	30
0.25	15
0.5	5
0.75	0

Fig. 7


Synthetic image
401 Obstacle
701
Start position
503
Tire trace
702
Parking position
402 Obstacle

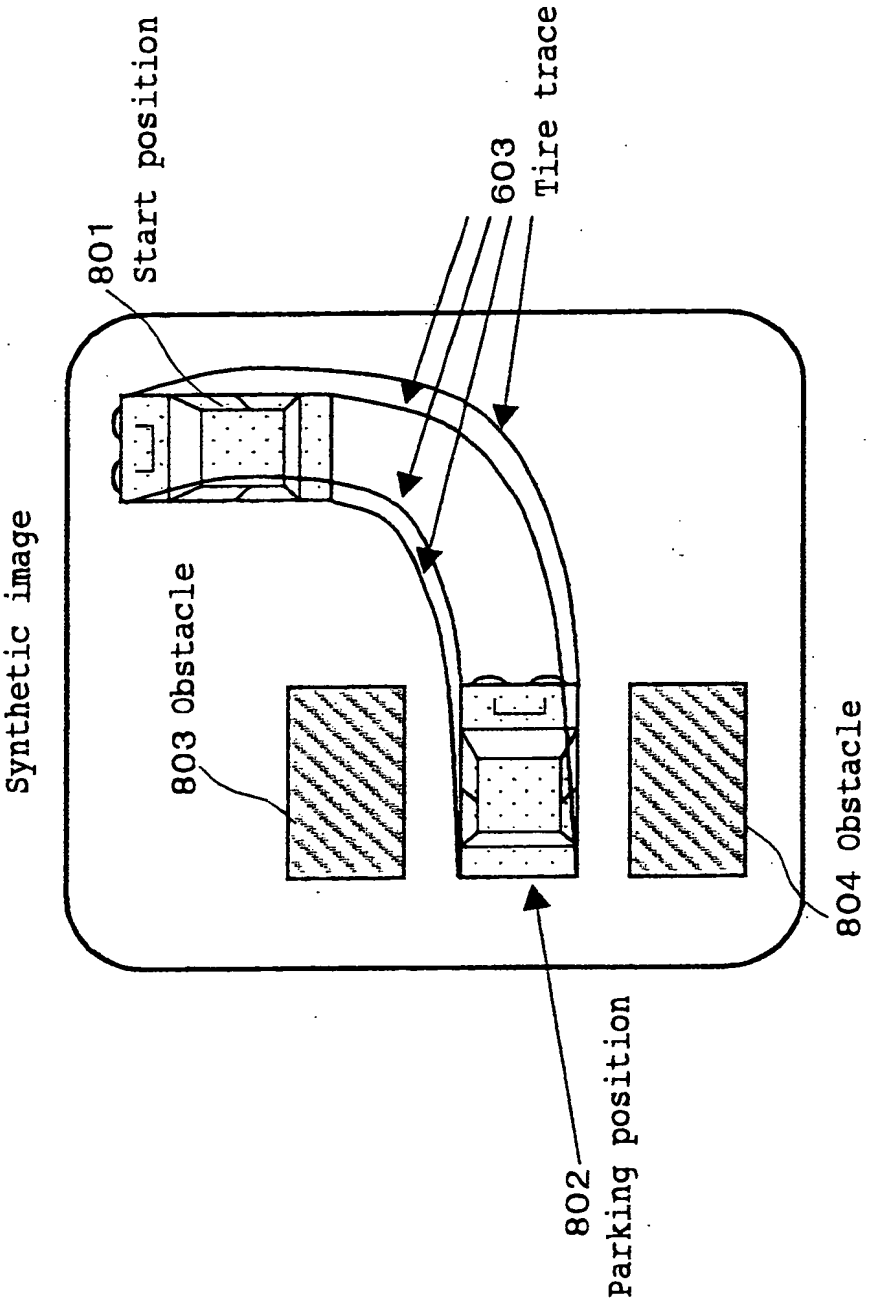

Synthetic image
801
Start position
603
Tire trace
803 Obstacle
804 Obstacle
802
Parking position

Fig. 8

Fig. 9

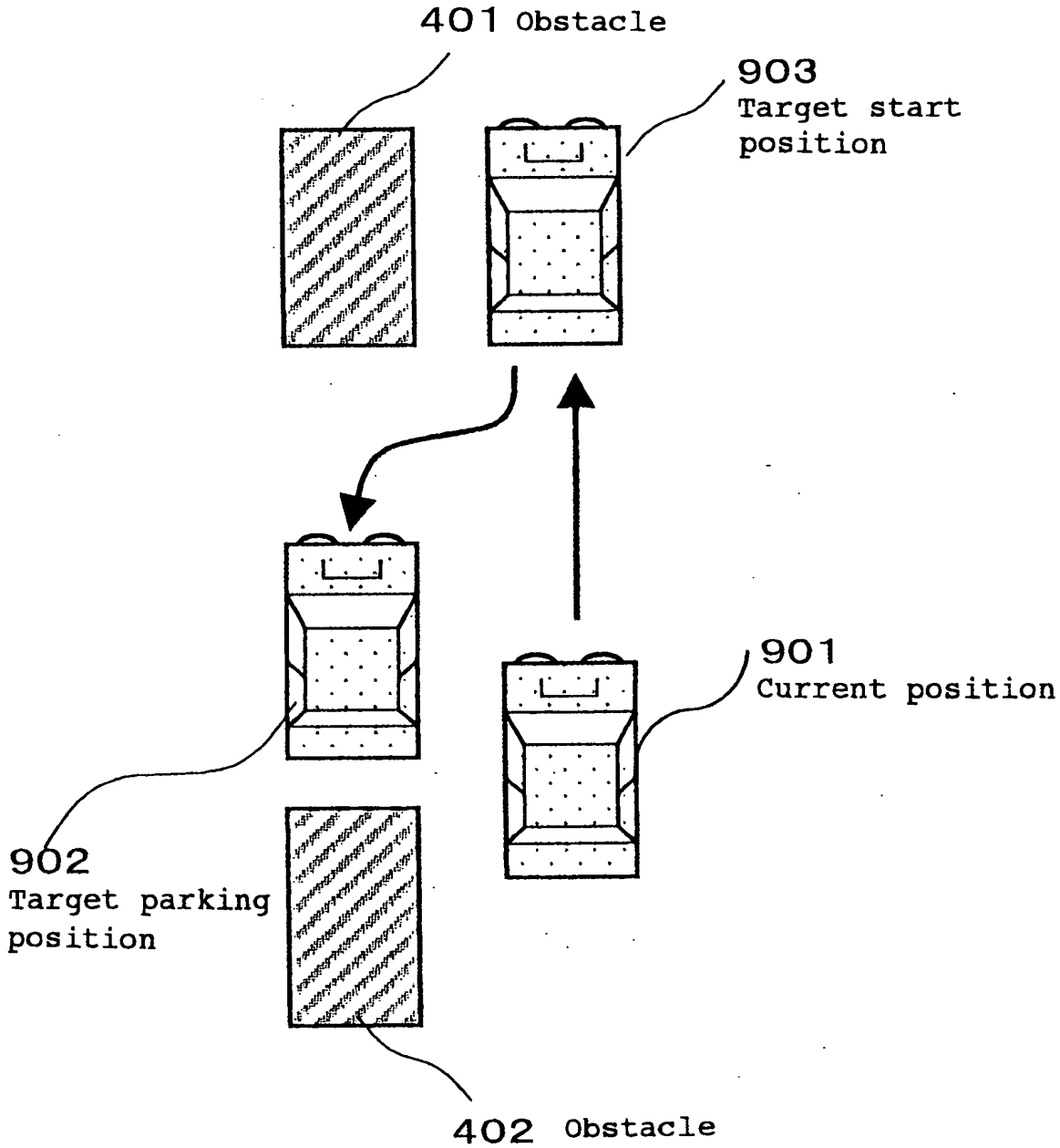

401 Obstacle
903
Target start position
901
Current position
902
Target parking position
402 Obstacle

Fig. 10 (a)

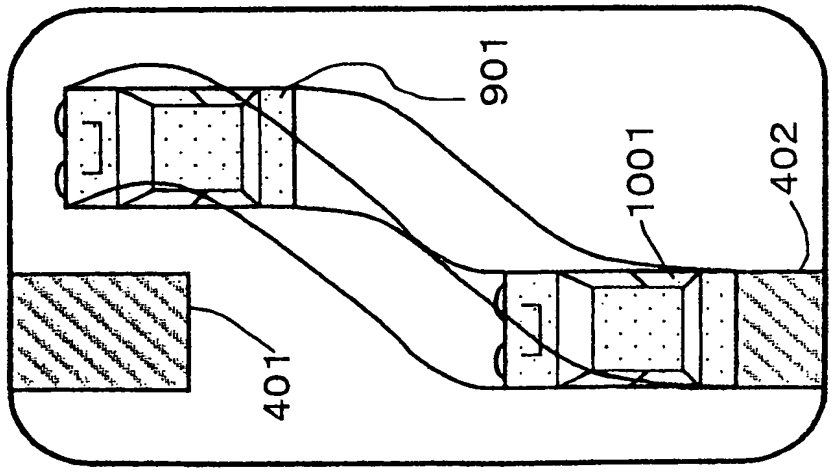


Fig. 10 (b)

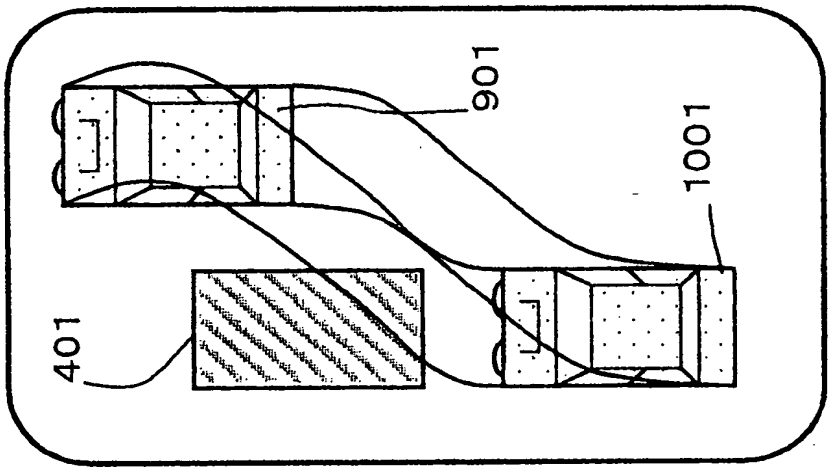


Fig. 10 (c)

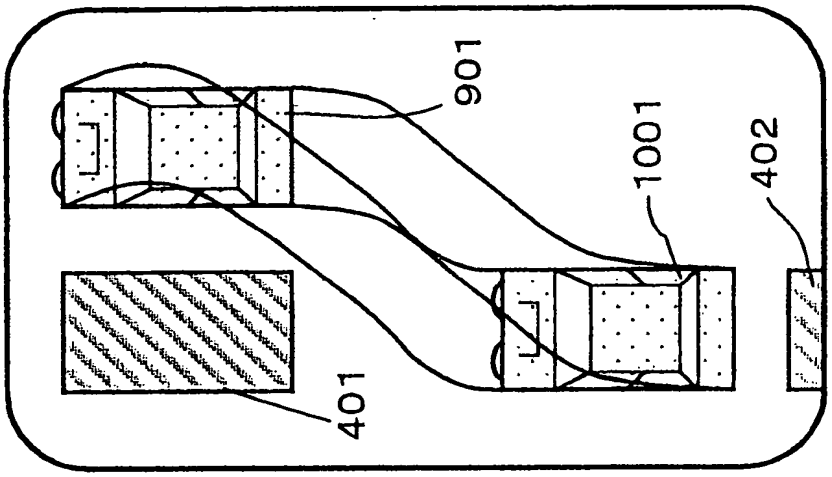
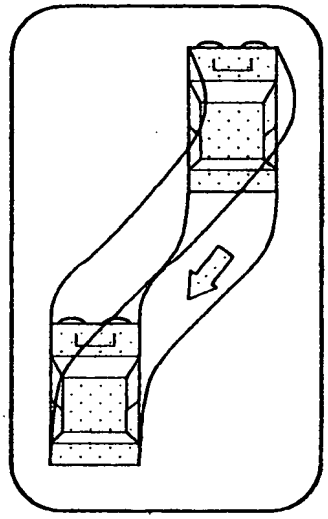
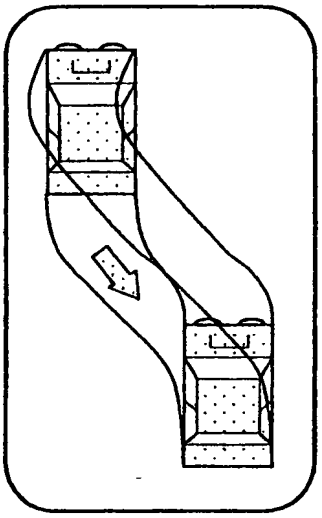


Fig. 11

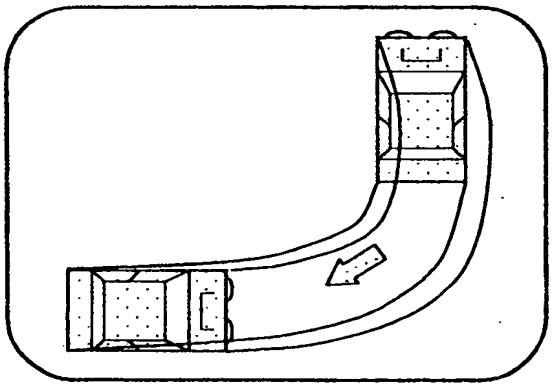
Assumed-movement pattern 1101



Assumed-movement pattern 1102



Assumed-movement pattern 1103



Assumed-movement pattern 1104

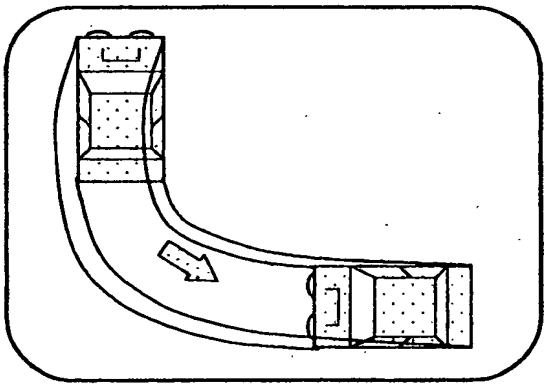


Fig. 12

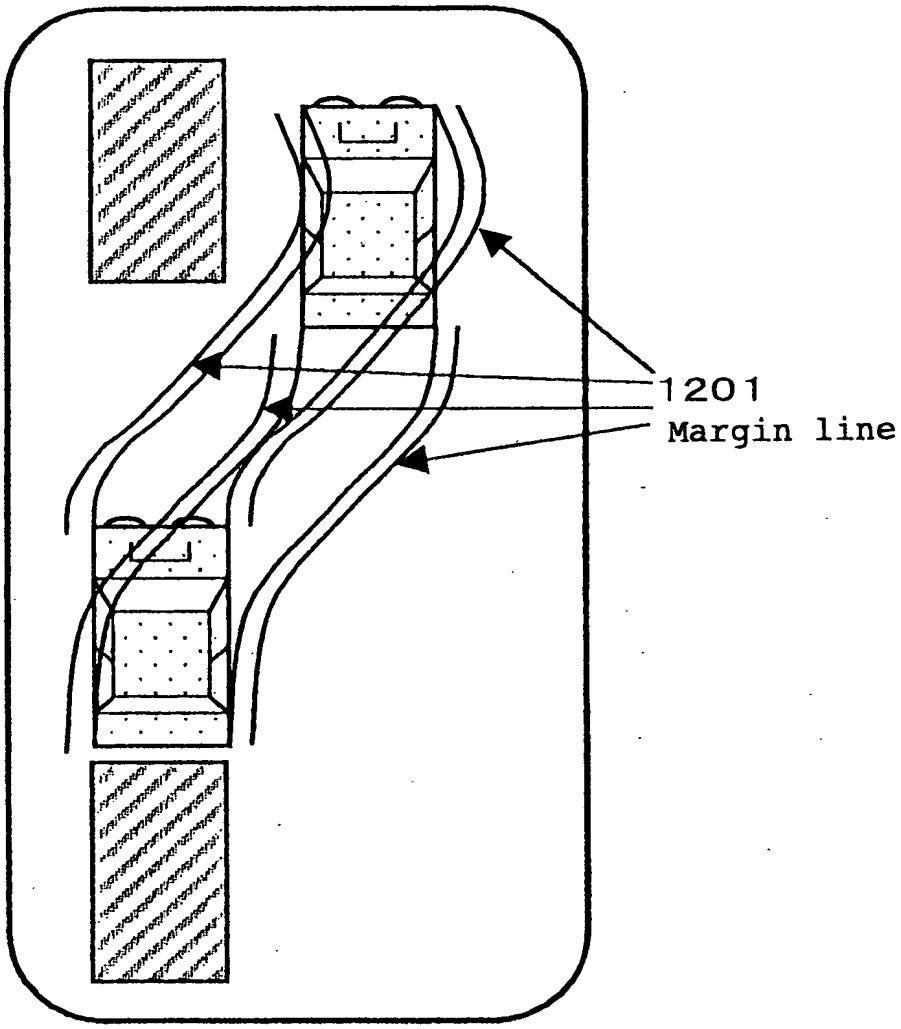


Fig. 13

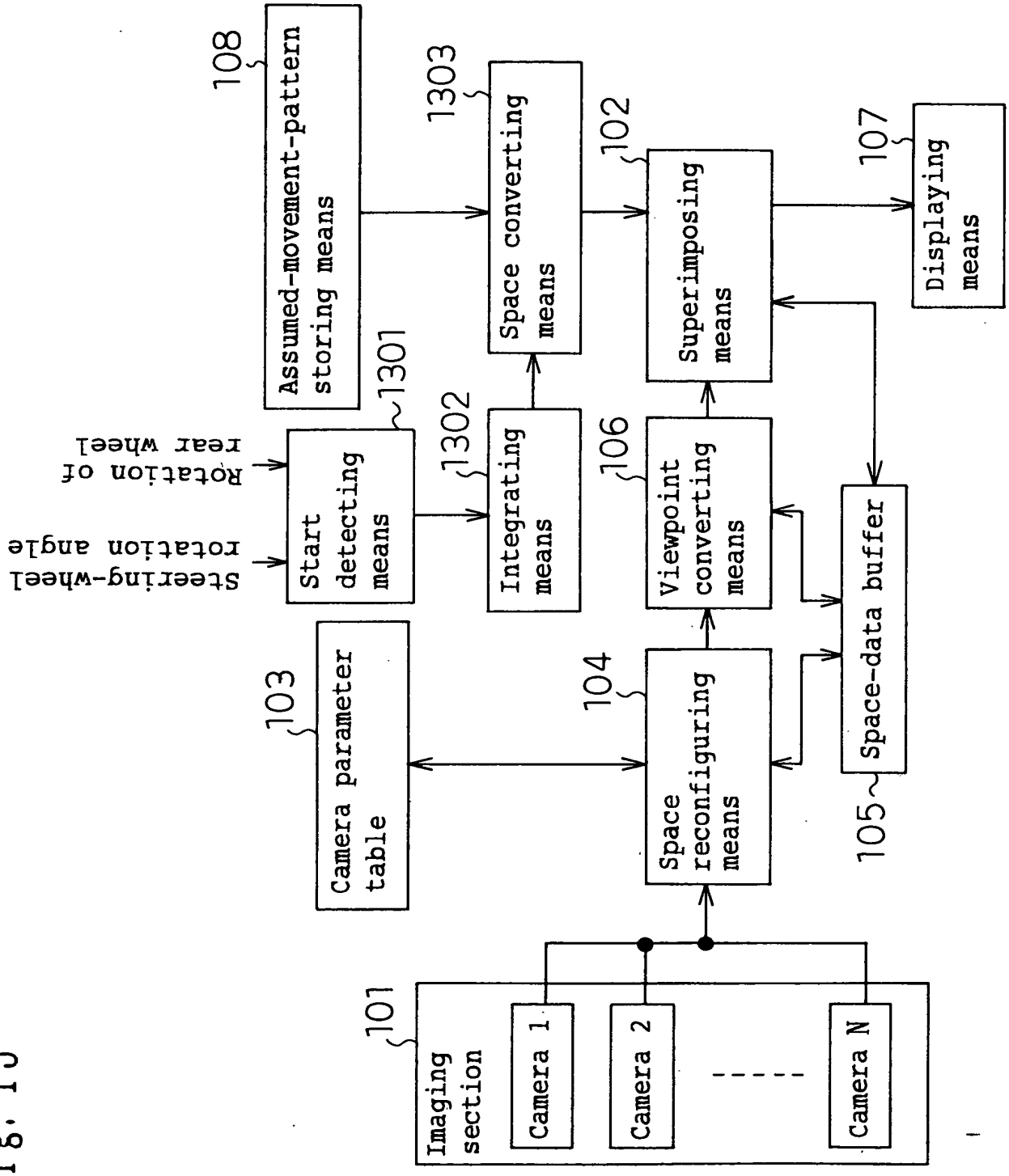

Imaging section
Camera 1
Camera 2
Camera N
101
Camera parameter table
103
Space reconfiguring means
104
Space-data buffer
105
Viewpoint converting means
106
Integrating means
1302
Start detecting means
1301
Steering-wheel rotation angle
Rotation of rear wheel
Assumed-movement-pattern storing means
108
Space converting means
1303
Superimposing means
102
Displaying means
107

Fig. 14 (a)

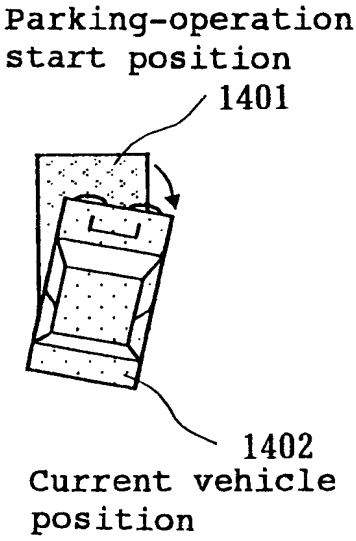


Fig. 14 (b)

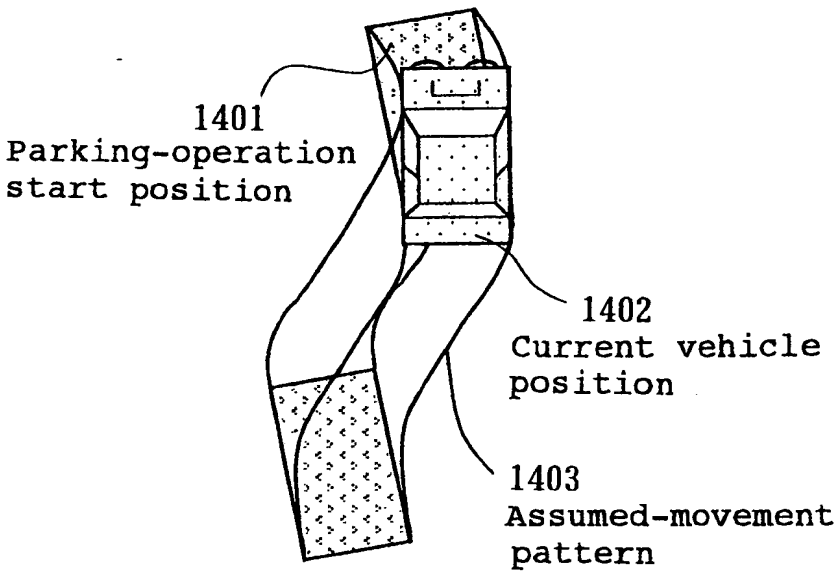
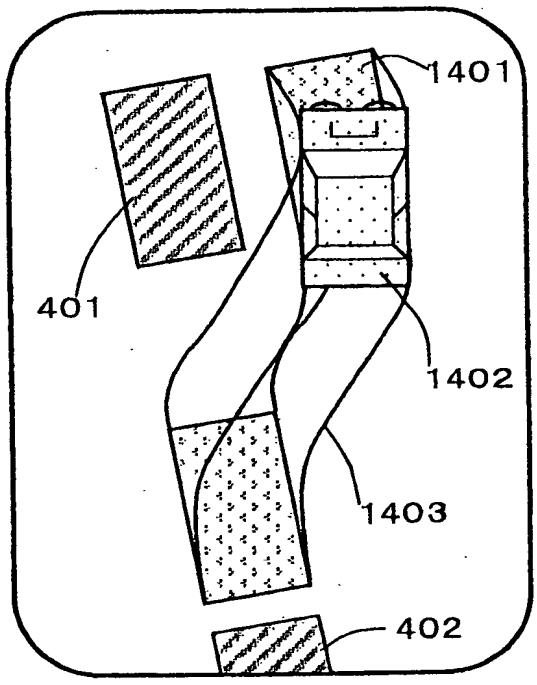


Fig. 14 (c)



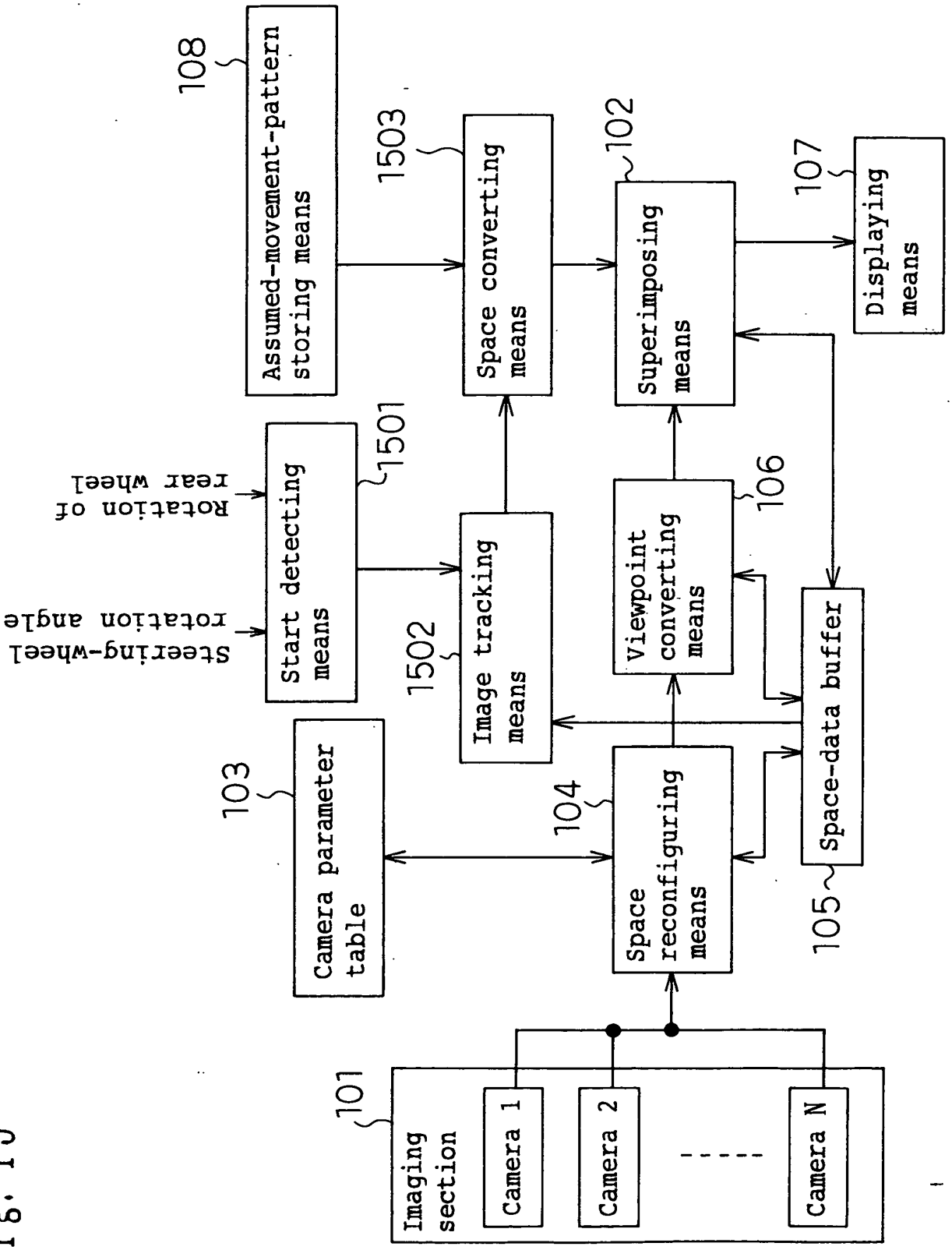

Imaging section
Camera 1
Camera 2
Camera N
101
Camera parameter table
103
Space reconfiguring means
104
Space-data buffer
105
Image tracking means
1502
Viewpoint converting means
106
Start detecting means
1501
Steering-wheel rotation angle
Rotation of rear wheel
Assumed-movement-pattern storing means
108
Space converting means
1503
Superimposing means
102
Displaying means
107

Fig. 15

Fig. 16 (a)

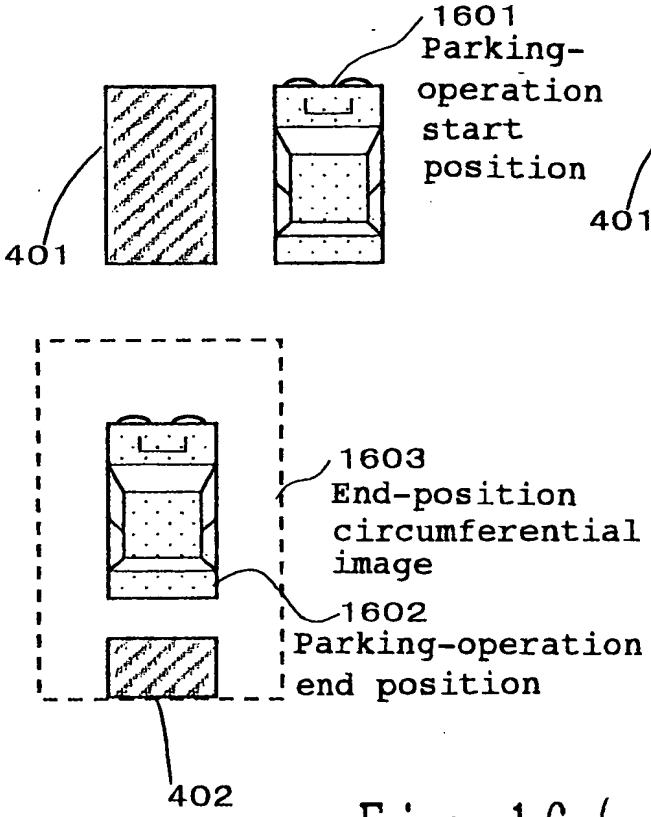


Fig. 16 (b)

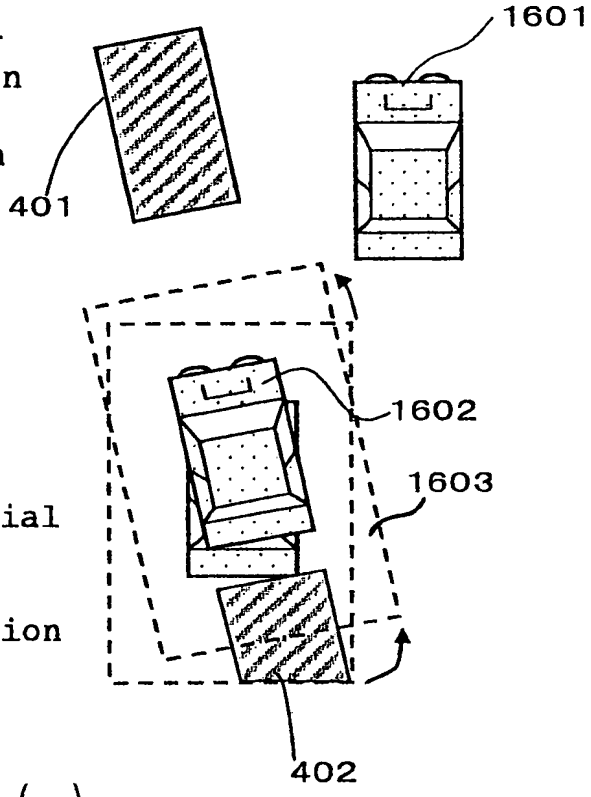


Fig. 16 (c)

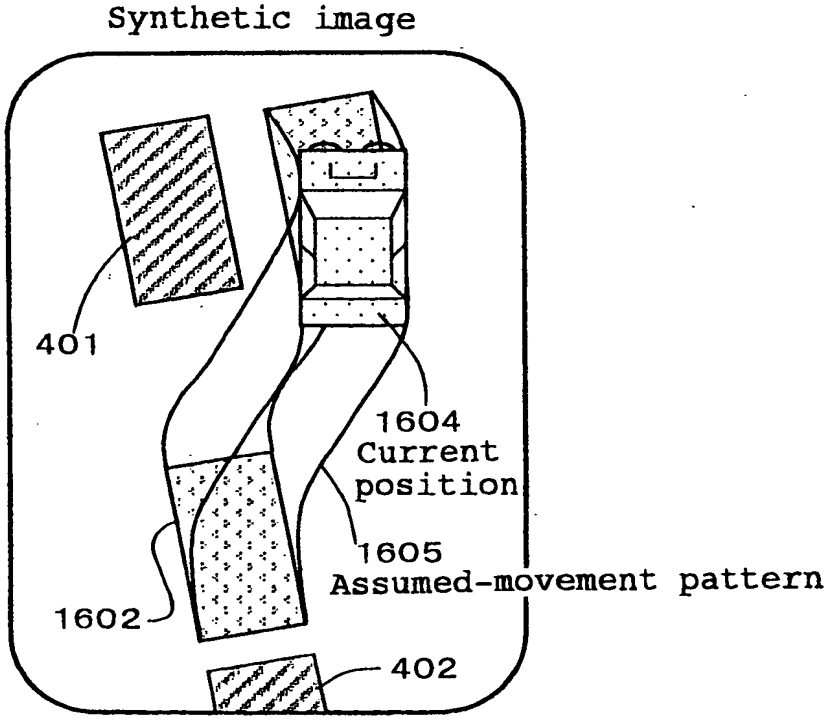


Fig. 17

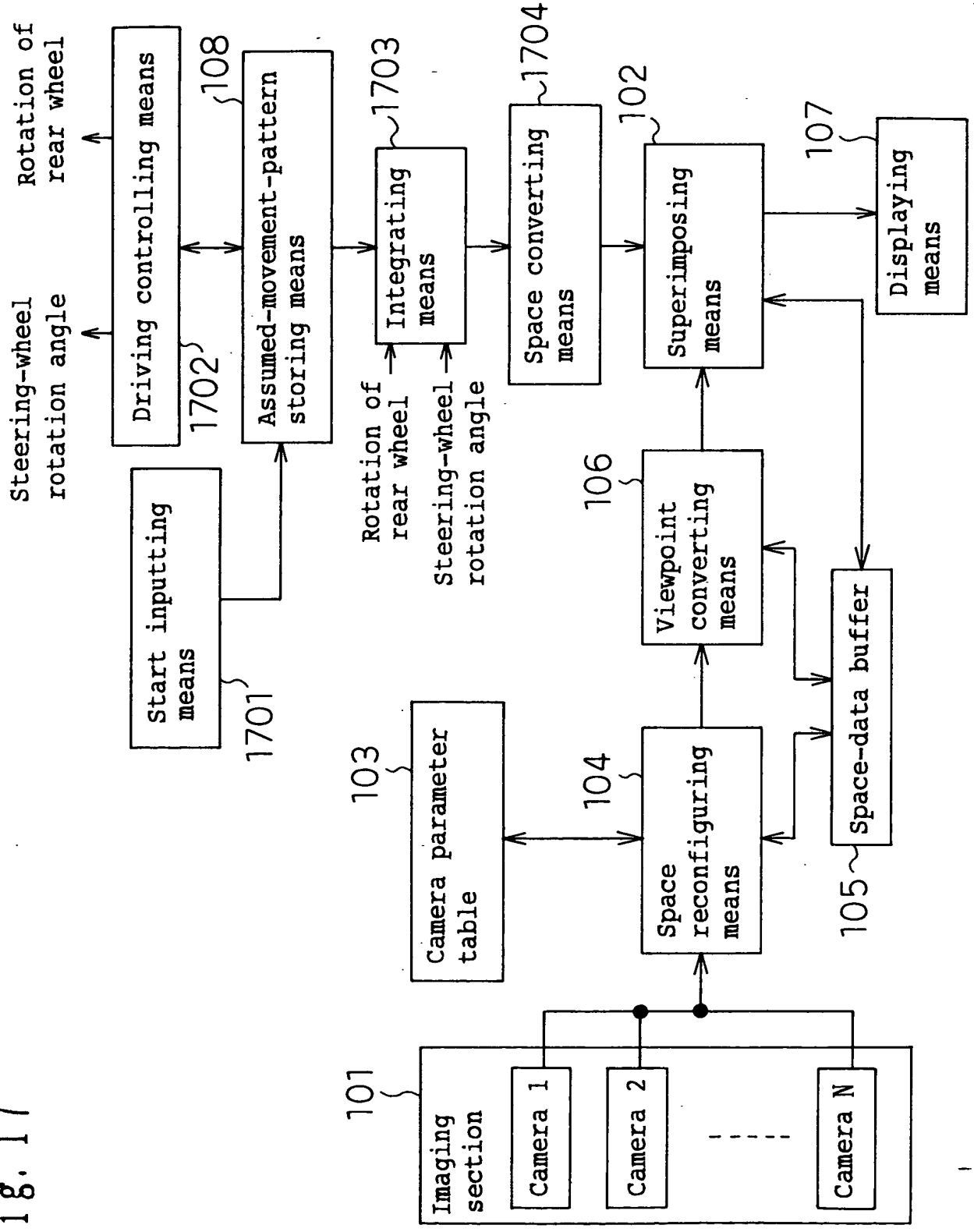

Steering-wheel rotation angle
Rotation of rear wheel
Driving controlling means
1702
108
Assumed-movement-pattern storing means
1703
Integrating means
1704
Space converting means
102
Superimposing means
107
Displaying means
Start inputting means
1701
Rotation of rear wheel
Steering-wheel rotation angle
106
Viewpoint converting means
103
Camera parameter table
104
Space reconfiguring means
Space-data buffer
105
101
Imaging section
Camera 1
Camera 2
Camera N

Fig. 18

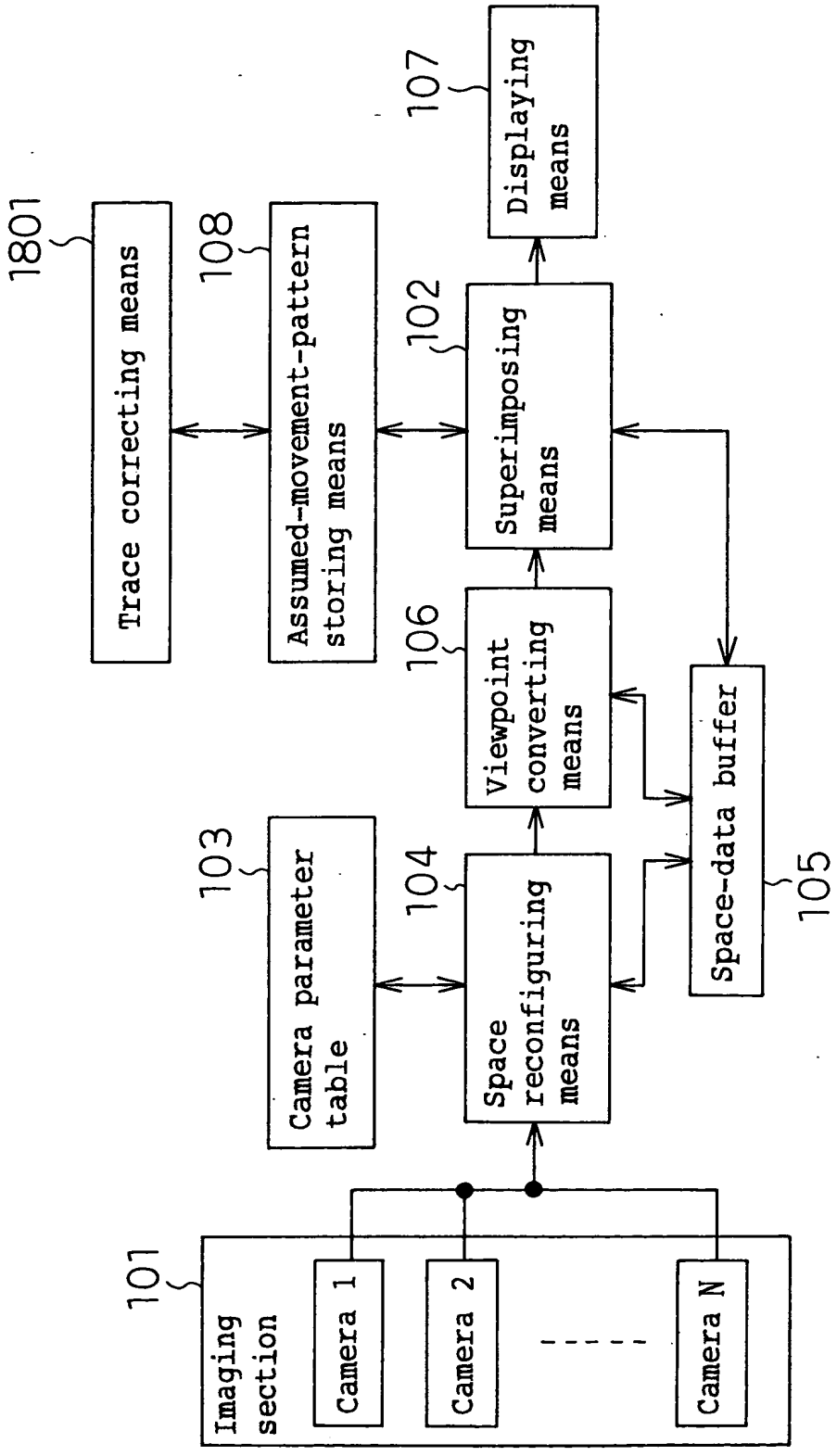

Imaging section
Camera 1
Camera 2
Camera N
101
Camera parameter table
103
Space reconfiguring means
104
Space-data buffer
105
Viewpoint converting means
106
Superimposing means
102
Displaying means
107
Assumed-movement-pattern storing means
108
Trace correcting means
1801

Fig. 19 (a)

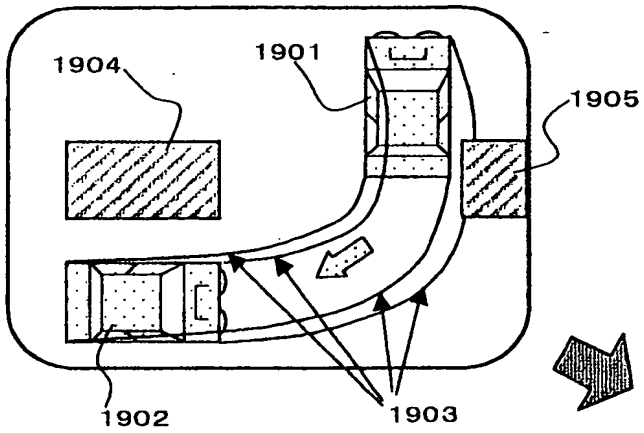


Fig. 19 (b)

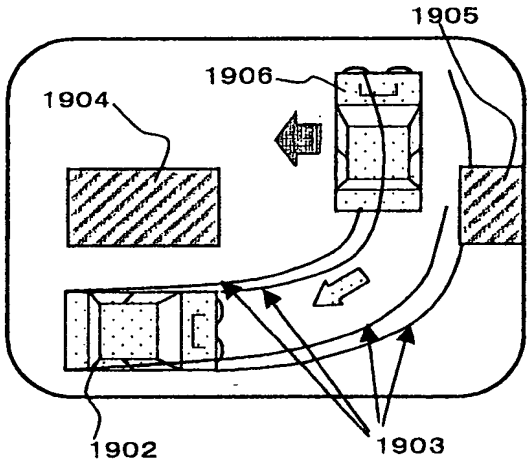


Fig. 19 (c)

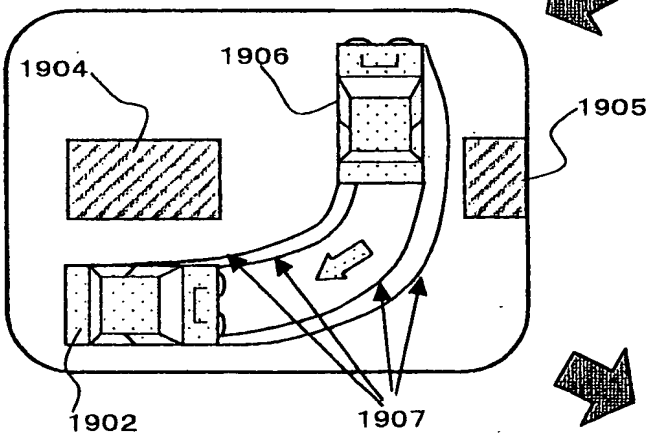
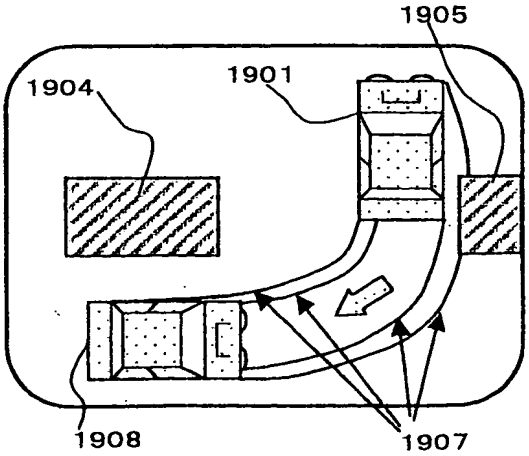


Fig. 19 (d)



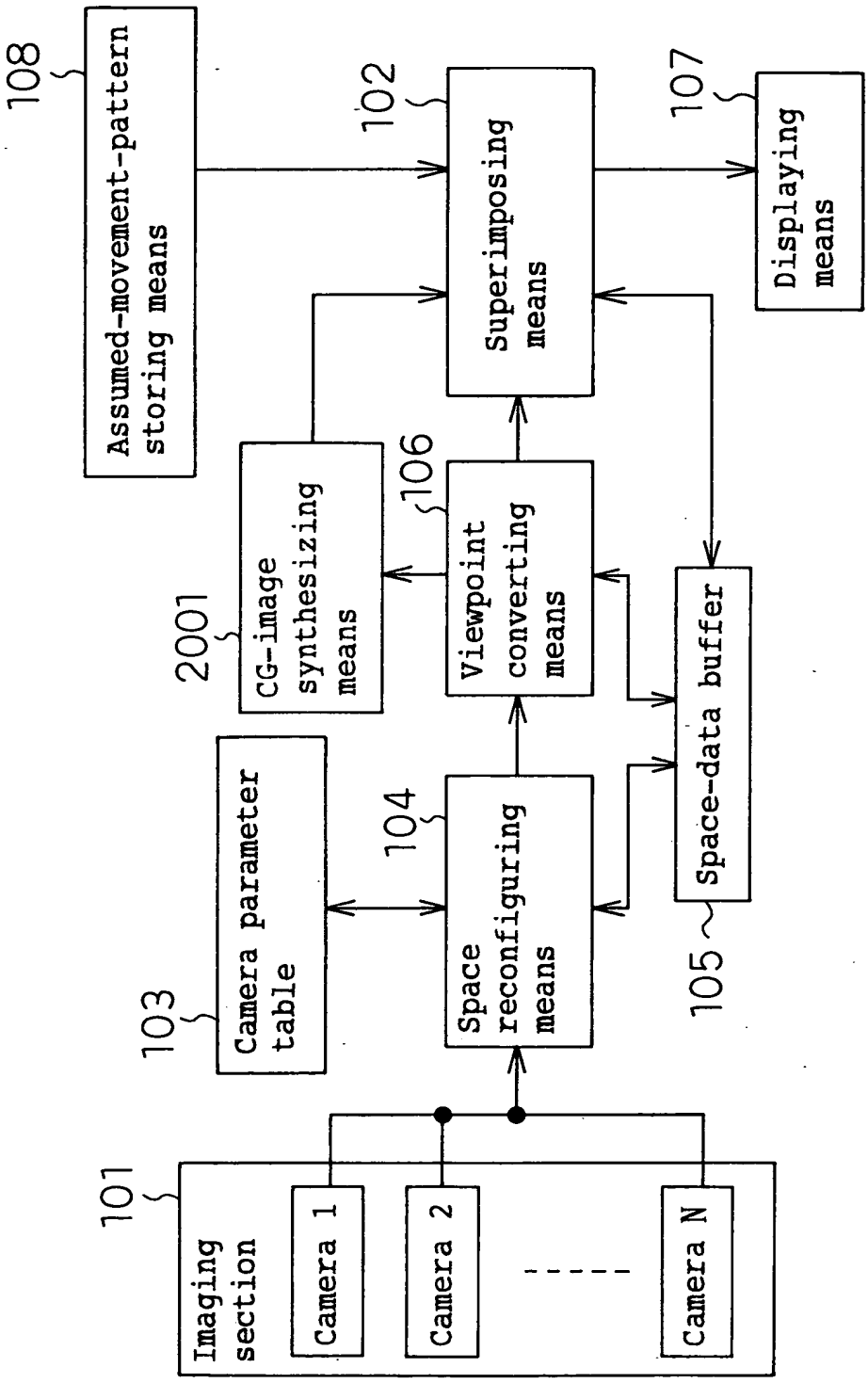

Imaging section
Camera 1
Camera 2
Camera N
101
Camera parameter table
103
Space reconfiguring means
104
Space-data buffer
105
CG-image synthesizing means
2001
Viewpoint converting means
106
Superimposing means
102
Assumed-movement-pattern storing means
108
Displaying means
107

Fig. 20

Fig. 21 (a)

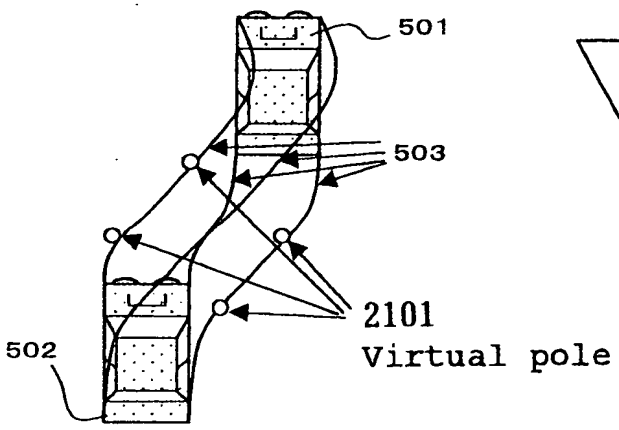


Fig. 21 (b)

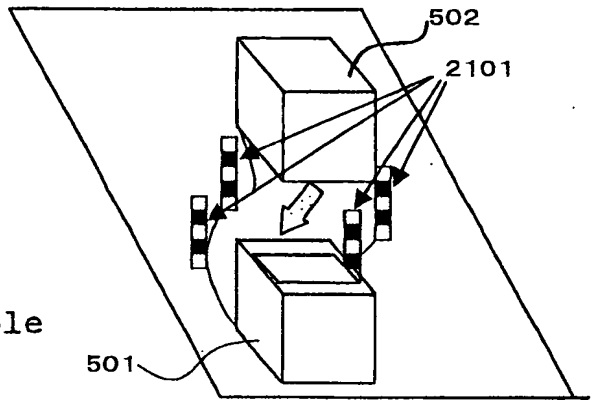


Fig. 21 (c)

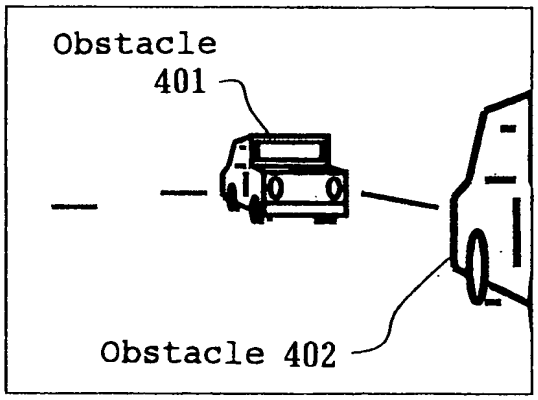


Fig. 21 (d)

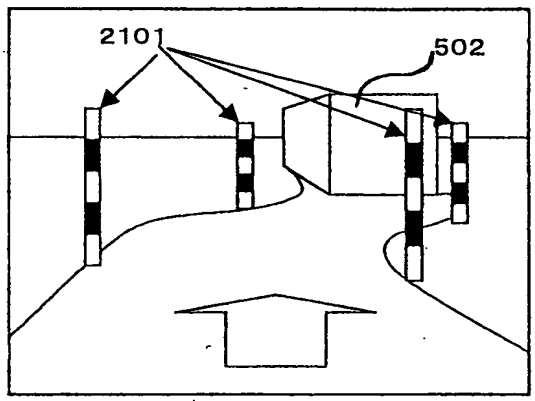
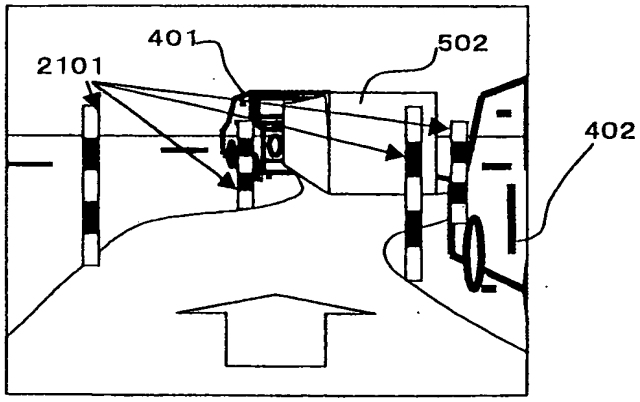


Fig. 21 (e)



0047420 "P0OT9560

Fig. 22

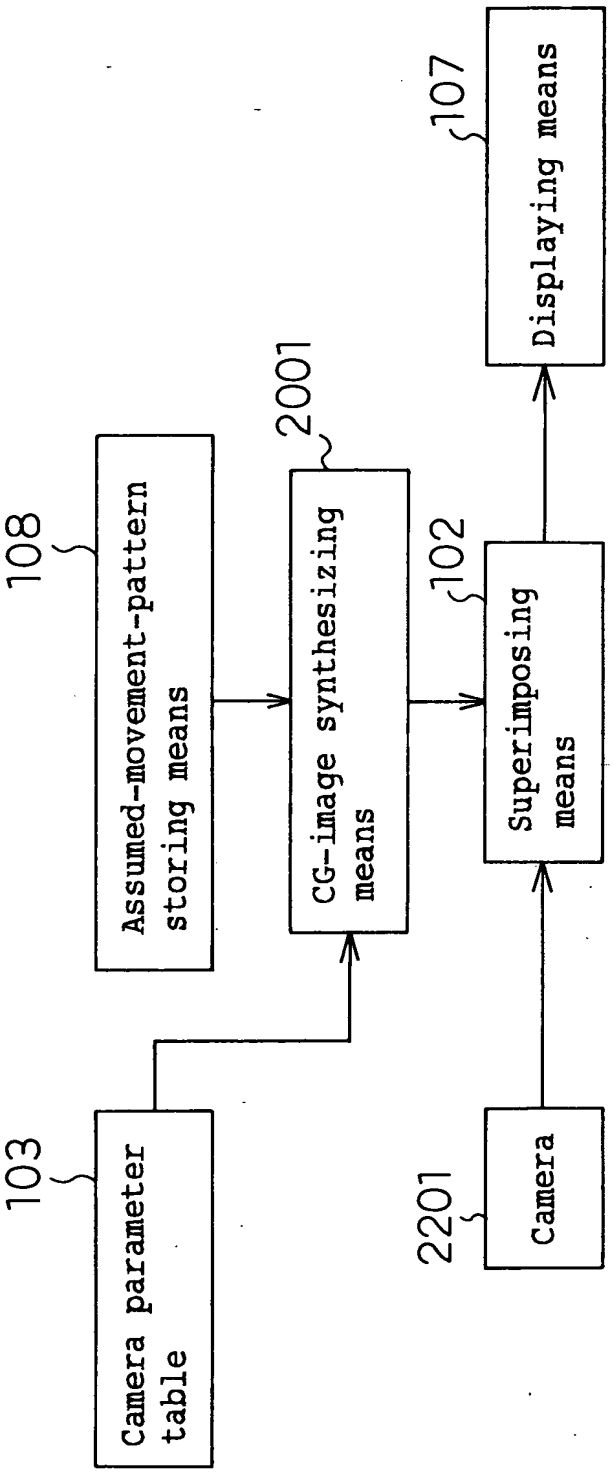


Fig. 23

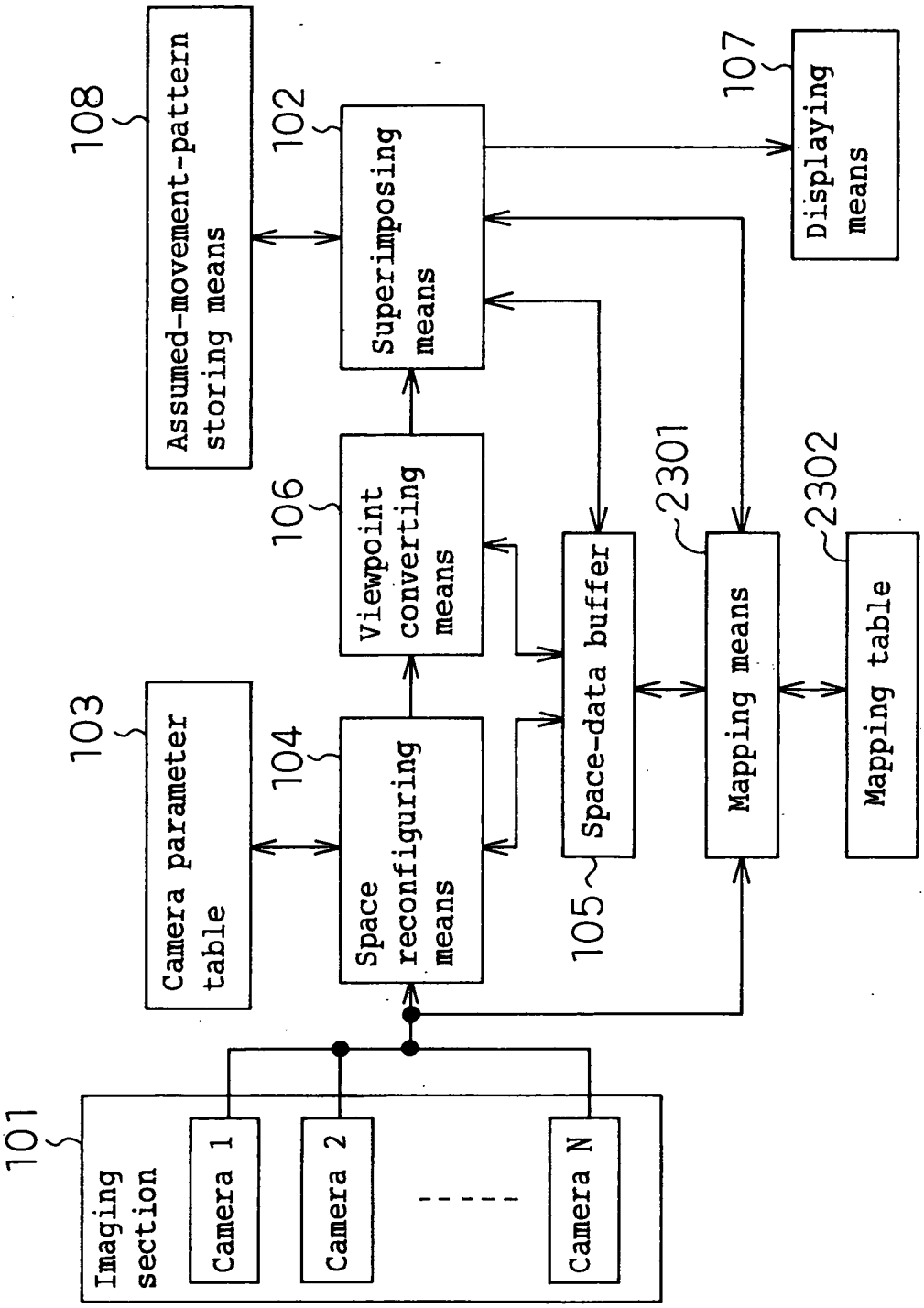

101
Imaging section
Camera 1
Camera 2
Camera N
103
Camera parameter table
104
Space reconfiguring means
105
Space-data buffer
106
Viewpoint converting means
108
Assumed-movement-pattern storing means
102
Superimposing means
107
Displaying means
2301
Mapping means
2302
Mapping table

Fig. 24

(1, 10, 10)	(1, 12, 12)		···		(3, 50, 80)
(1, 11, 11)	(1, 12, 13)		···		(3, 49, 82)
(1, 12, 12)	(1, 12, 14)		···		(3, 48, 84)
·	·				·
·	·				·
·	·				·
·	·				·
·	·				·
·	·				·
(2, 0, 100)	(2, 2, 102)		···		(3, 0, 192)

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Fig. 25

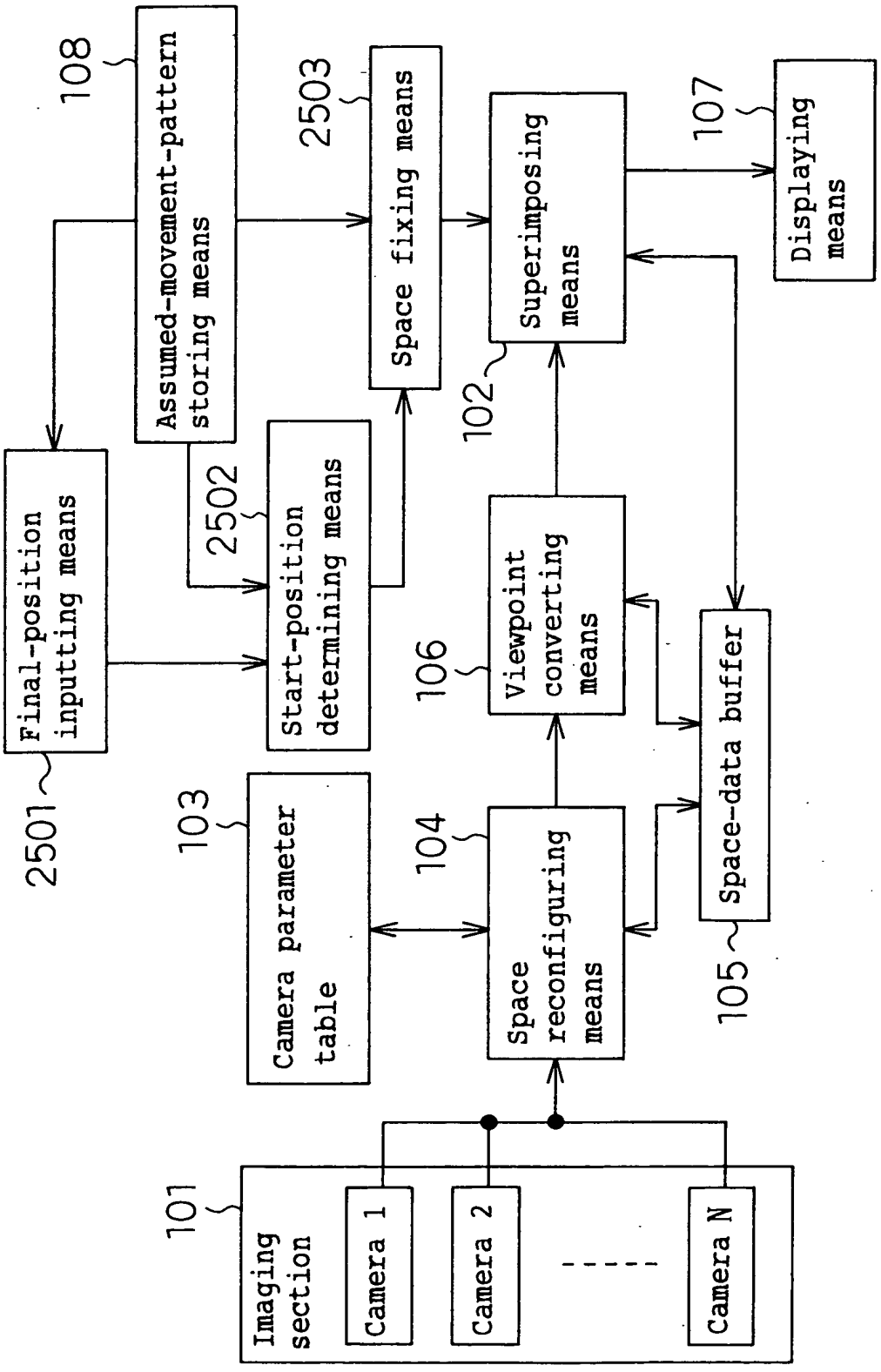
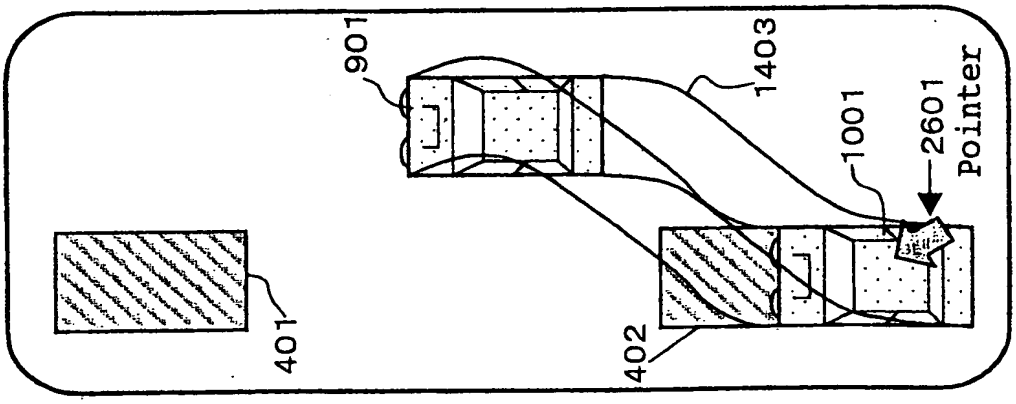
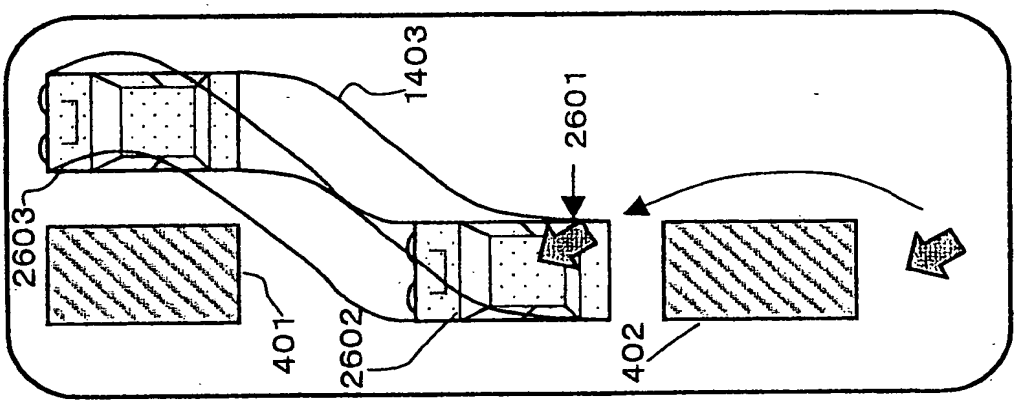

101
Imaging section
Camera 1
Camera 2
Camera N
103
Camera parameter table
104
Space reconfiguring means
105
Space-data buffer
106
Viewpoint converting means
102
Superimposing means
107
Displaying means
2501
Final-position inputting means
2502
Start-position determining means
2503
Space fixing means
108
Assumed-movement-pattern storing means

Fig. 26 (a)



Setting of operation end position to target position

Fig. 26 (b)



Driving toward start position (Fixing of assumed- movement pattern to ground)

Fig. 26 (c)

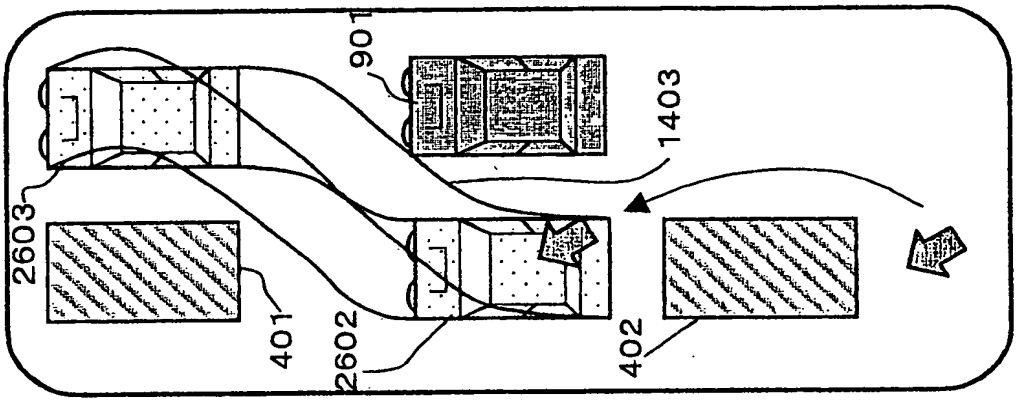


Fig. 27

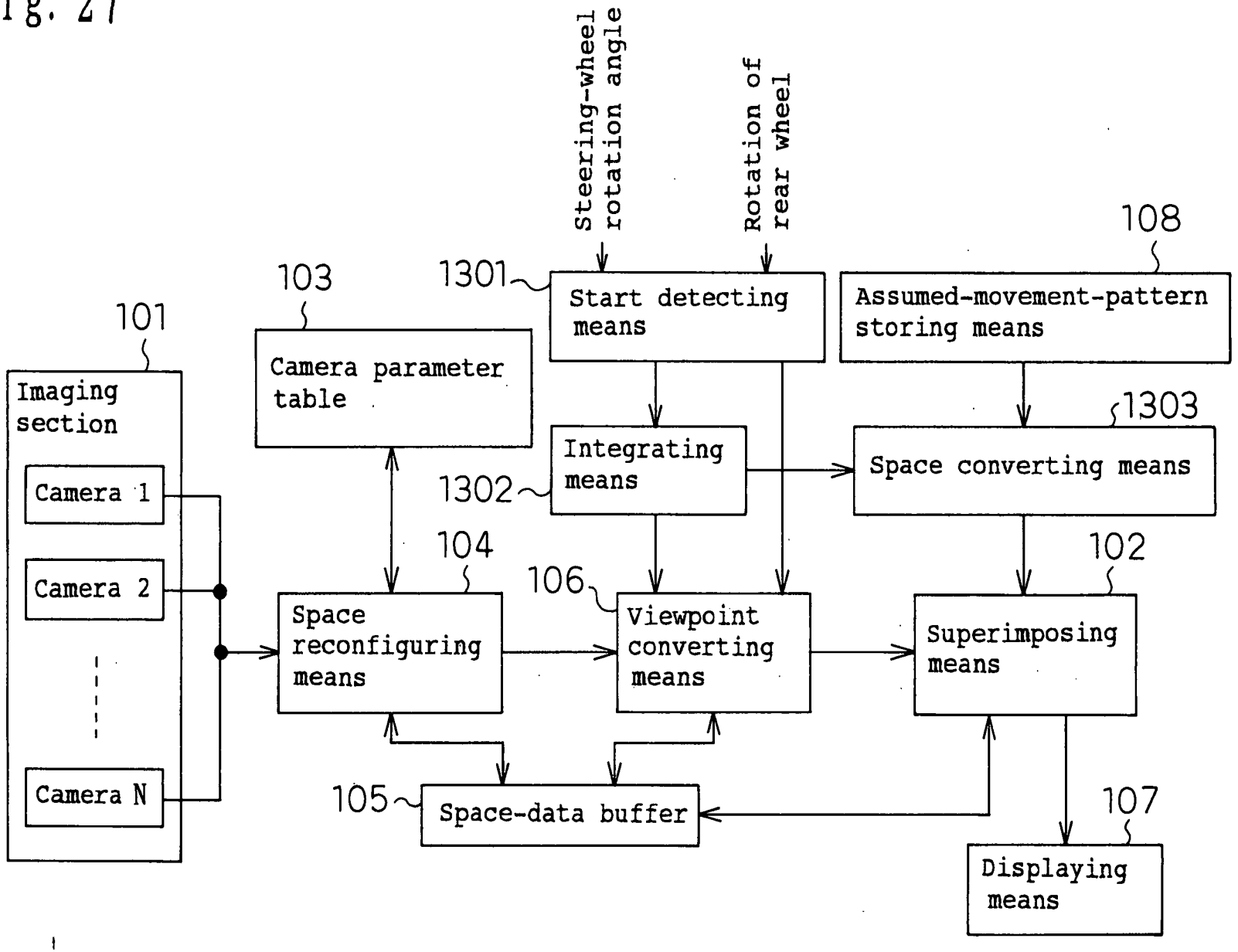


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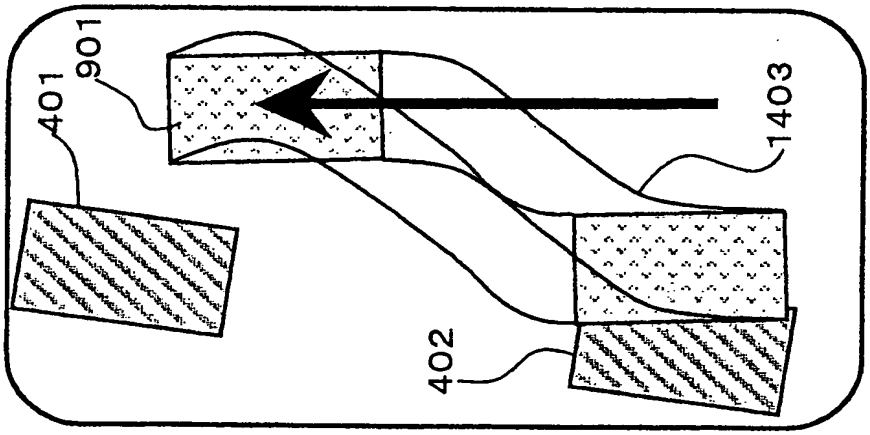
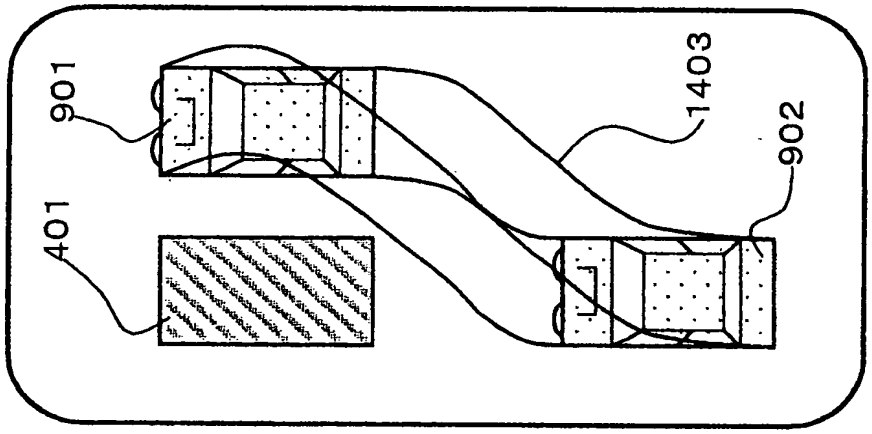
Fig. 28 (a)



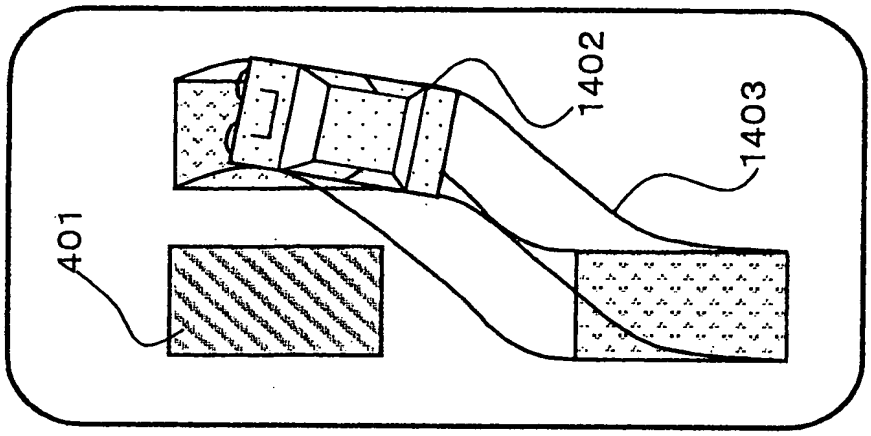
① Fixing of viewpoint to vehicle

Fig. 28 (b)



② Start of driving operation

Fig. 28 (c)



③ Fixing of viewpoint to space (Ground)

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Fig. 29

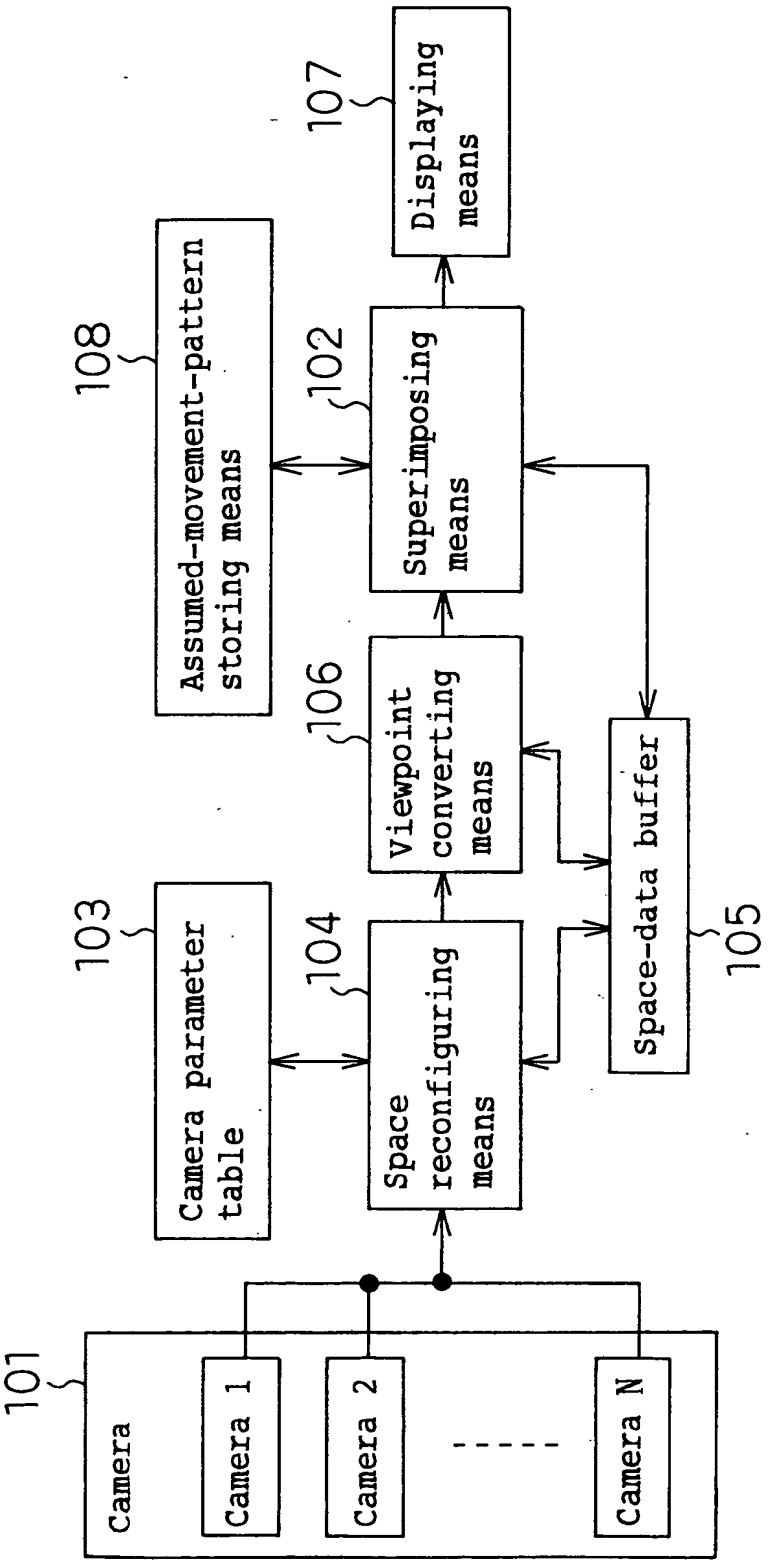

Fig. 30 (a)

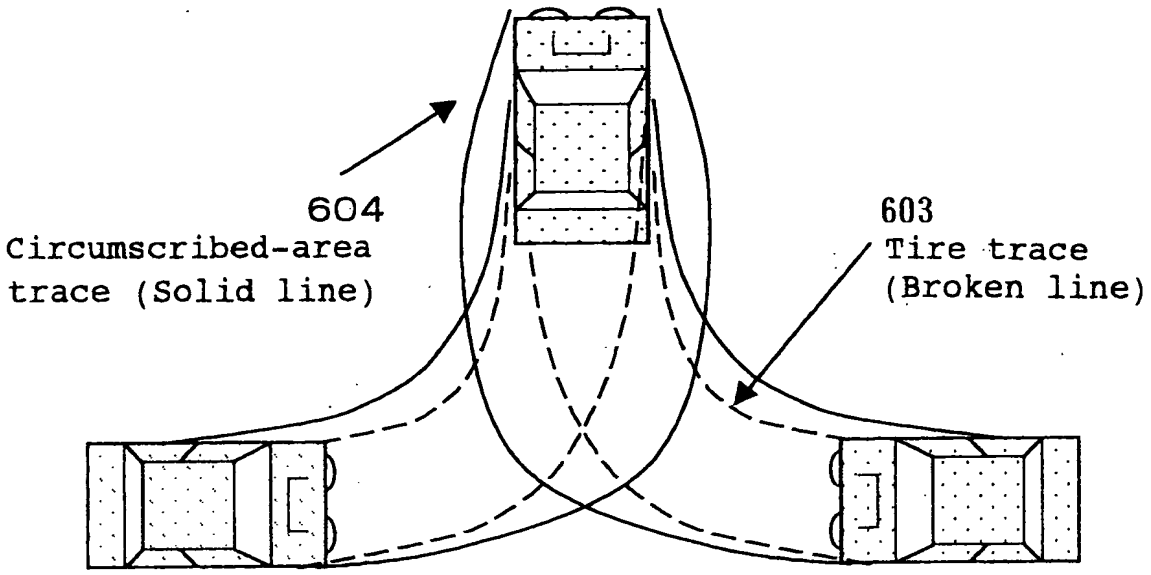

Fig. 30 (b)

Tire	Hand	Hand
0.2	180	-180
0.4	180	-180
0.6	180	-180
0.8	180	-180
1	180	-180
1.2	180	-180
1.4	180	-180
1.6	180	-180
1.8	180	-180
2	180	-180

Fig. 31

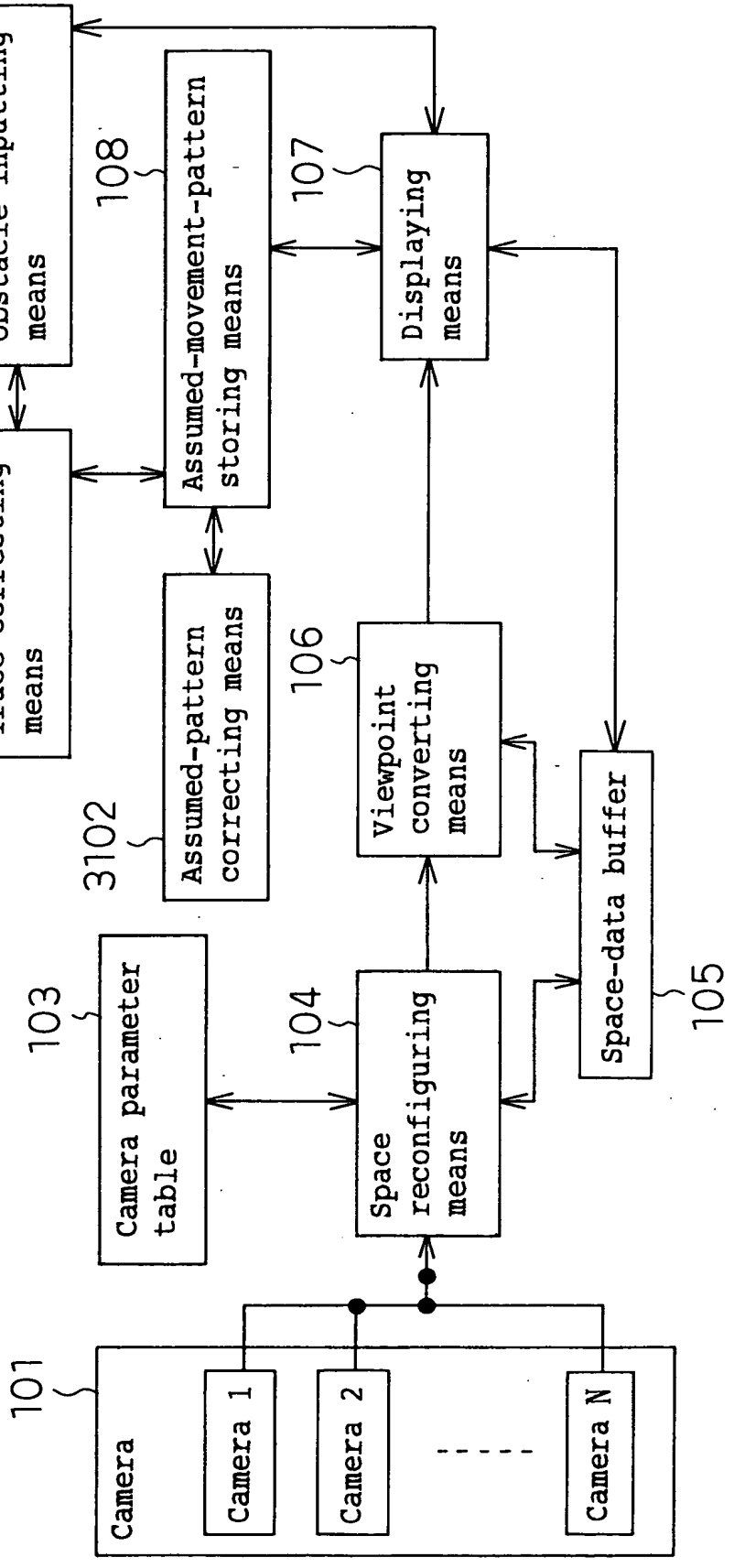
Camera
Camera 1
Camera 2
Camera N
101
Camera parameter table
103
Space reconfiguring means
104
Space-data buffer
105
Viewpoint converting means
106
Displaying means
107
Assumed-movement-pattern storing means
108
Assumed-pattern correcting means
3102
Trace correcting means
1801
Obstacle inputting means
3101

Fig. 32 (a)

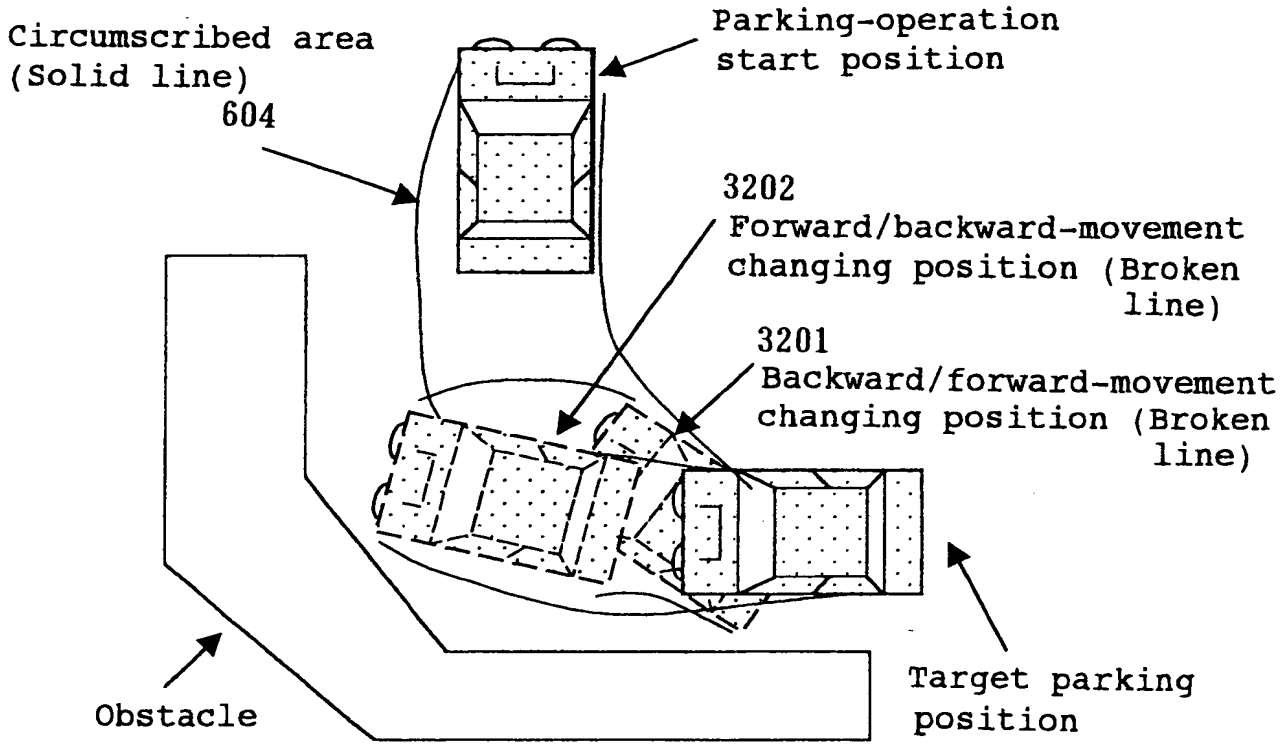

Fig. 32 (b)

Tire	Hand
0.2	180
0.4	180
0.6	180
0.8	180
0.8	-180
0.6	-180
0.6	180
0.8	180
1	90
1.2	30
1.4	0

Fig. 33

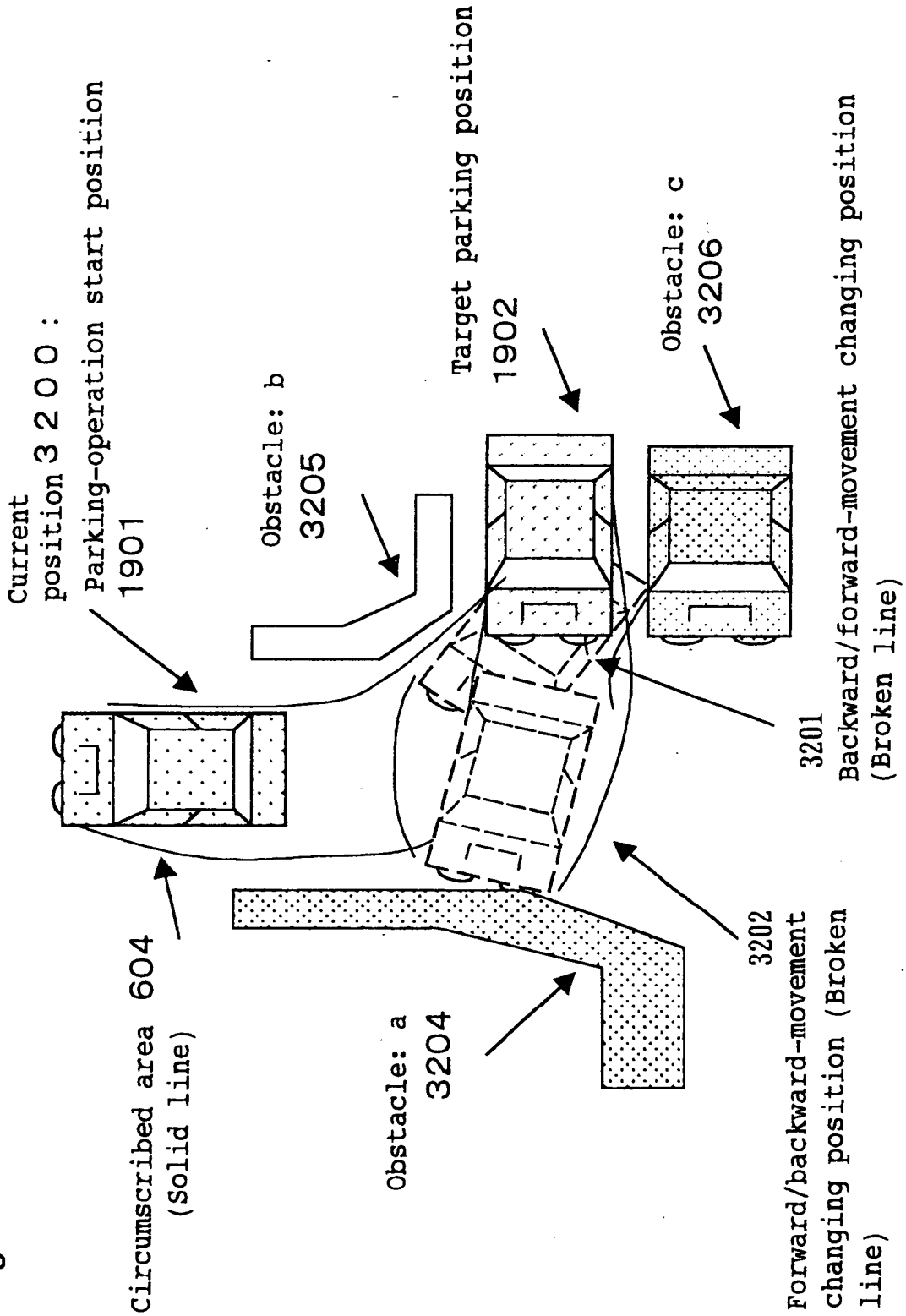
Current position 3200 : Parking-operation start position 1901
Obstacle: b 3205
Target parking position 1902
Obstacle: c 3206
3201 Backward/forward-movement changing position (Broken line)
Circumscribed area 604 (Solid line)
Obstacle: a 3204
3202 Forward/backward-movement changing position (Broken line)

Fig. 34

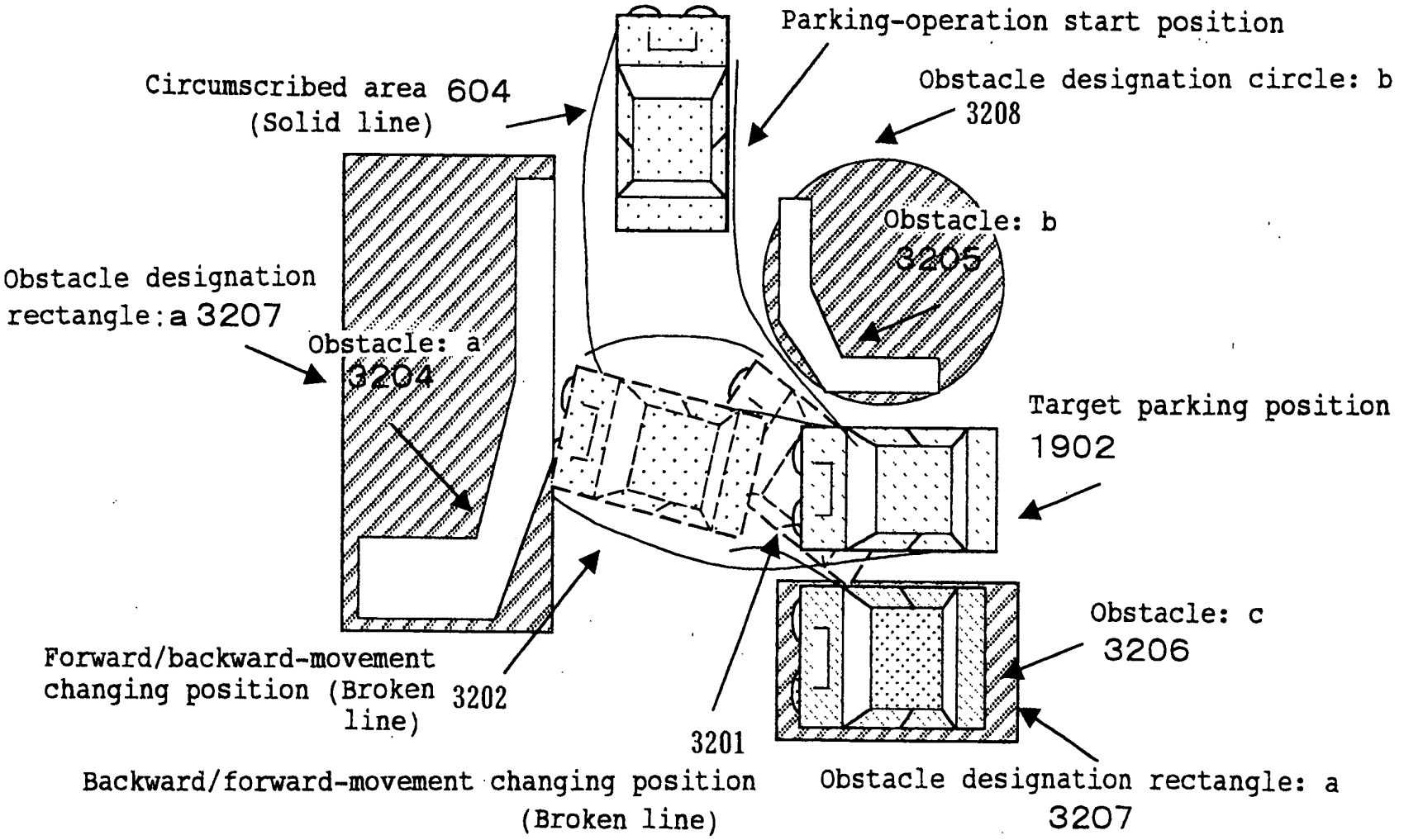
Parking-operation start position
Circumscribed area 604
(Solid line)
Obstacle designation circle: b
3208
Obstacle: b
3205
Obstacle designation
rectangle: a 3207
Obstacle: a
3204
Target parking position
1902
Obstacle: c
3206
Forward/backward-movement
changing position (Broken
line)
3202
3201
Backward/forward-movement changing position
(Broken line)
Obstacle designation rectangle: a
3207

Fig. 35

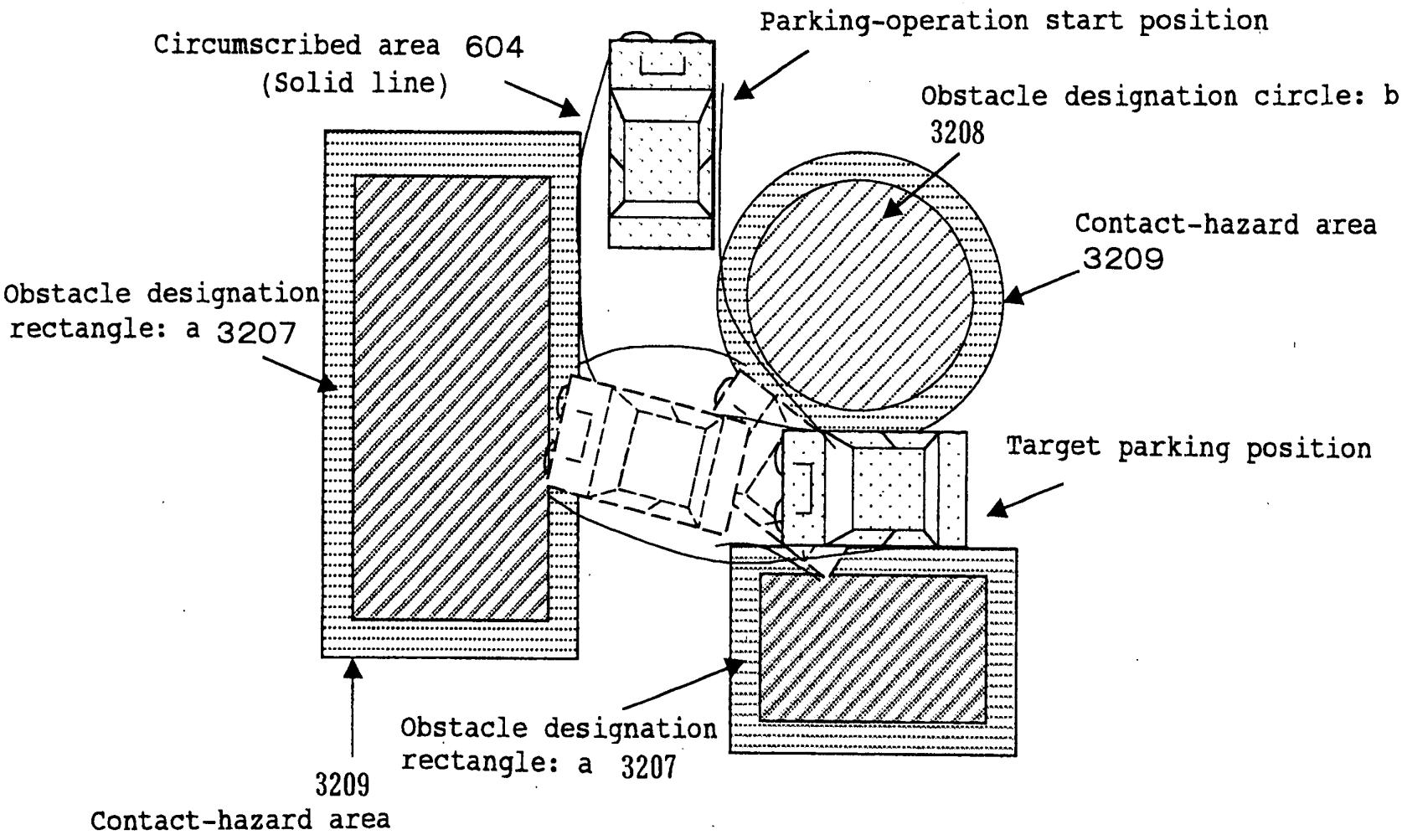

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Fig. 36

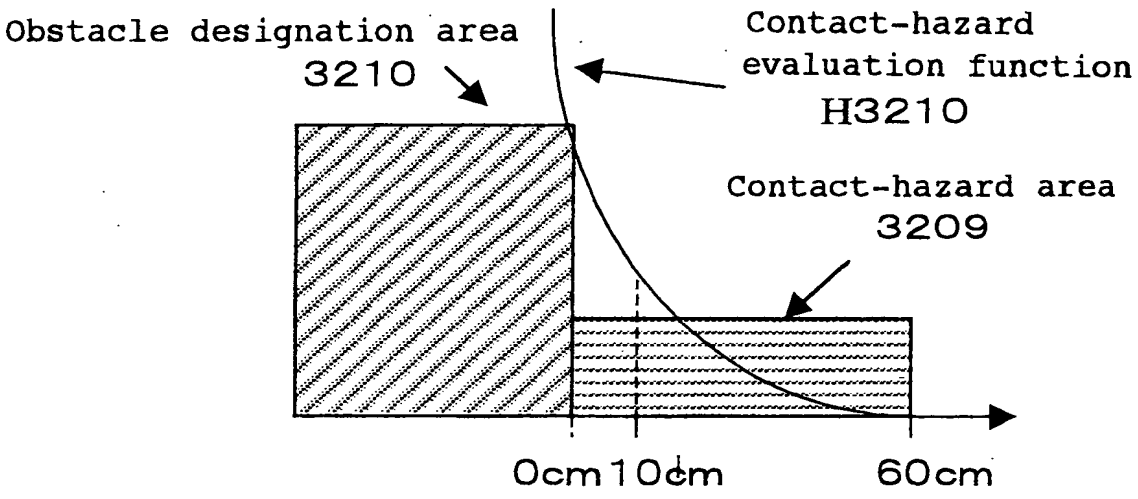
Obstacle designation area
3210
Contact-hazard
evaluation function
H3210
Contact-hazard area
3209
0cm
10cm
60cm

Fig. 37

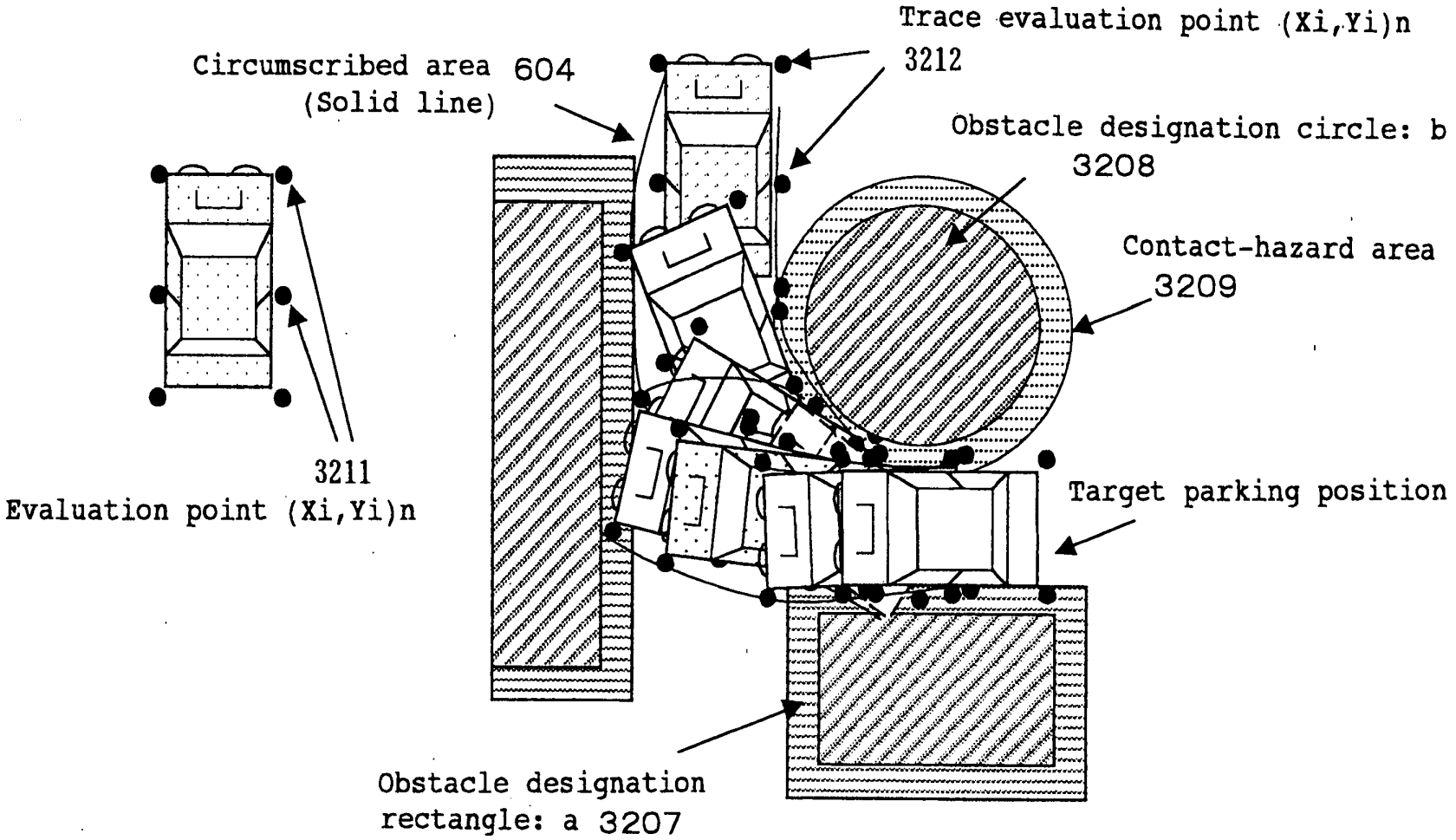

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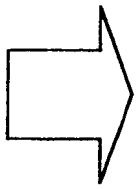
Fig. 38

$$H'' = \Sigma n \Sigma i H(Xi, Yi) n$$

$$= \Sigma n \Sigma i H(fx(tm, km), fy(tm, km)) n$$

Fig. 39

Tire	Hand
0.2	180
0.4	180
0.6	180
0.8	180
0.8	-180
0.6	-180
0.6	180
0.8	180
1	90
1.2	30
1.4	0



Tire	Hand
0.2	30
0.4	120
0.7	180
0.9	180
0.9	-180
0.7	-180
0.7	180
0.9	180
1.1	90
1.2	30
1.4	0

Fig. 40

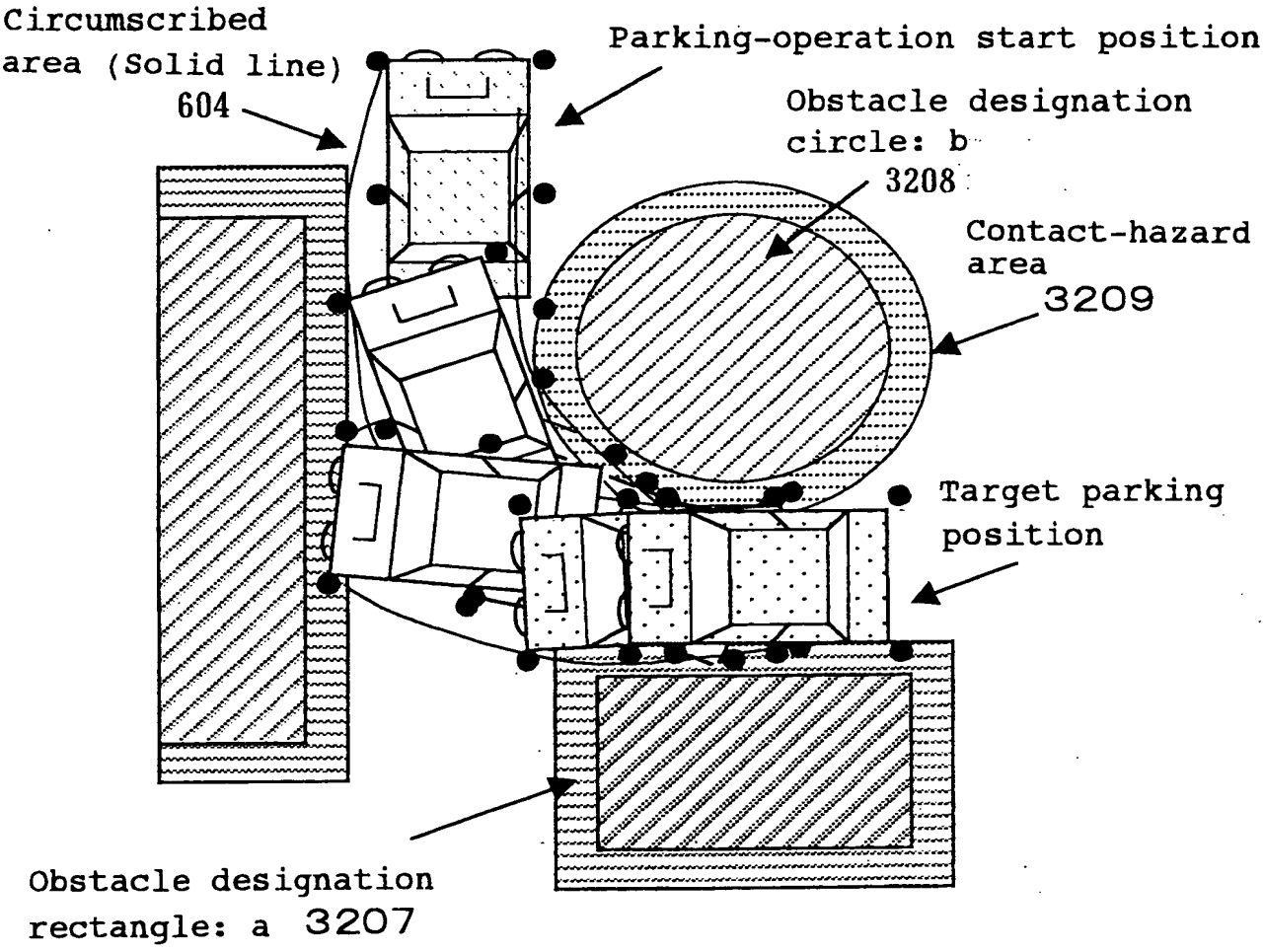

Circumscribed area (Solid line) 604
Parking-operation start position
Obstacle designation circle: b 3208
Contact-hazard area 3209
Target parking position
Obstacle designation rectangle: a 3207

Fig. 41

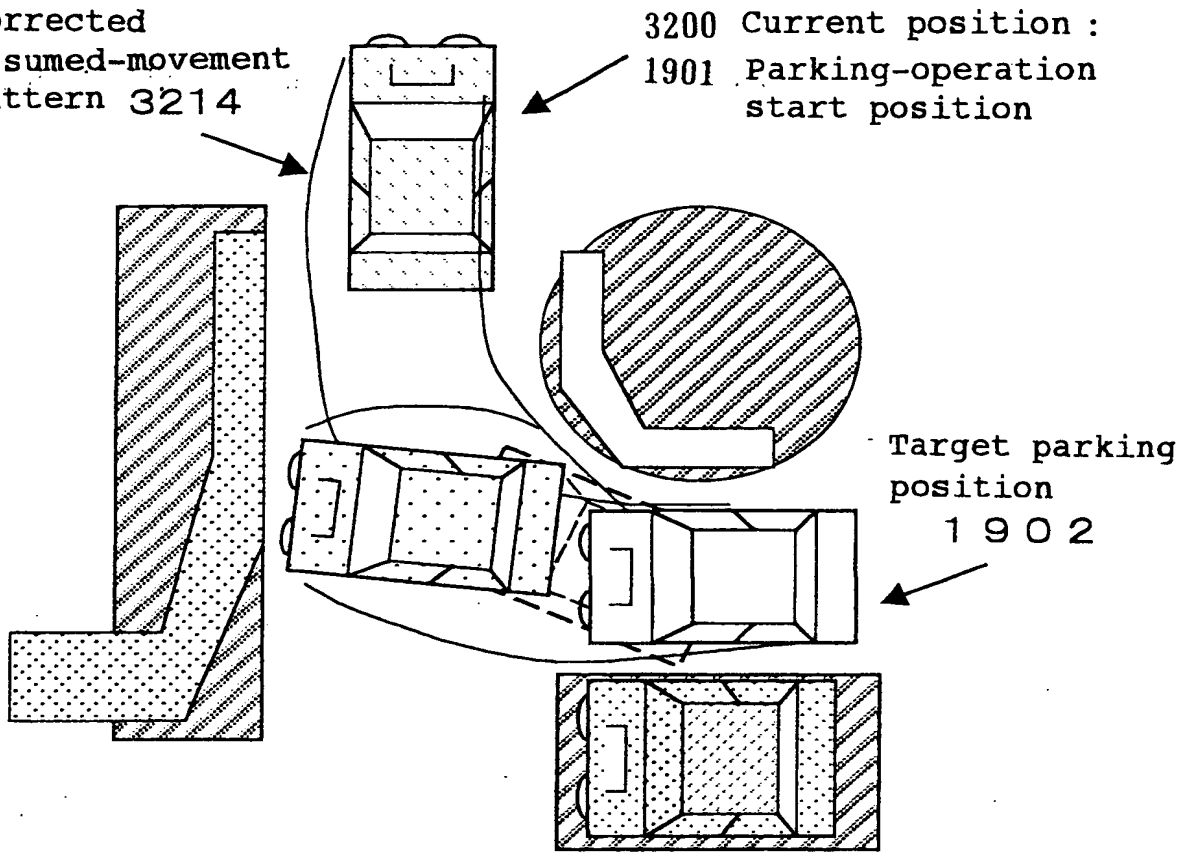

Corrected
assumed-movement
pattern 3214
3200 Current position :
1901 Parking-operation
start position
Target parking
position
1902

Fig. 42

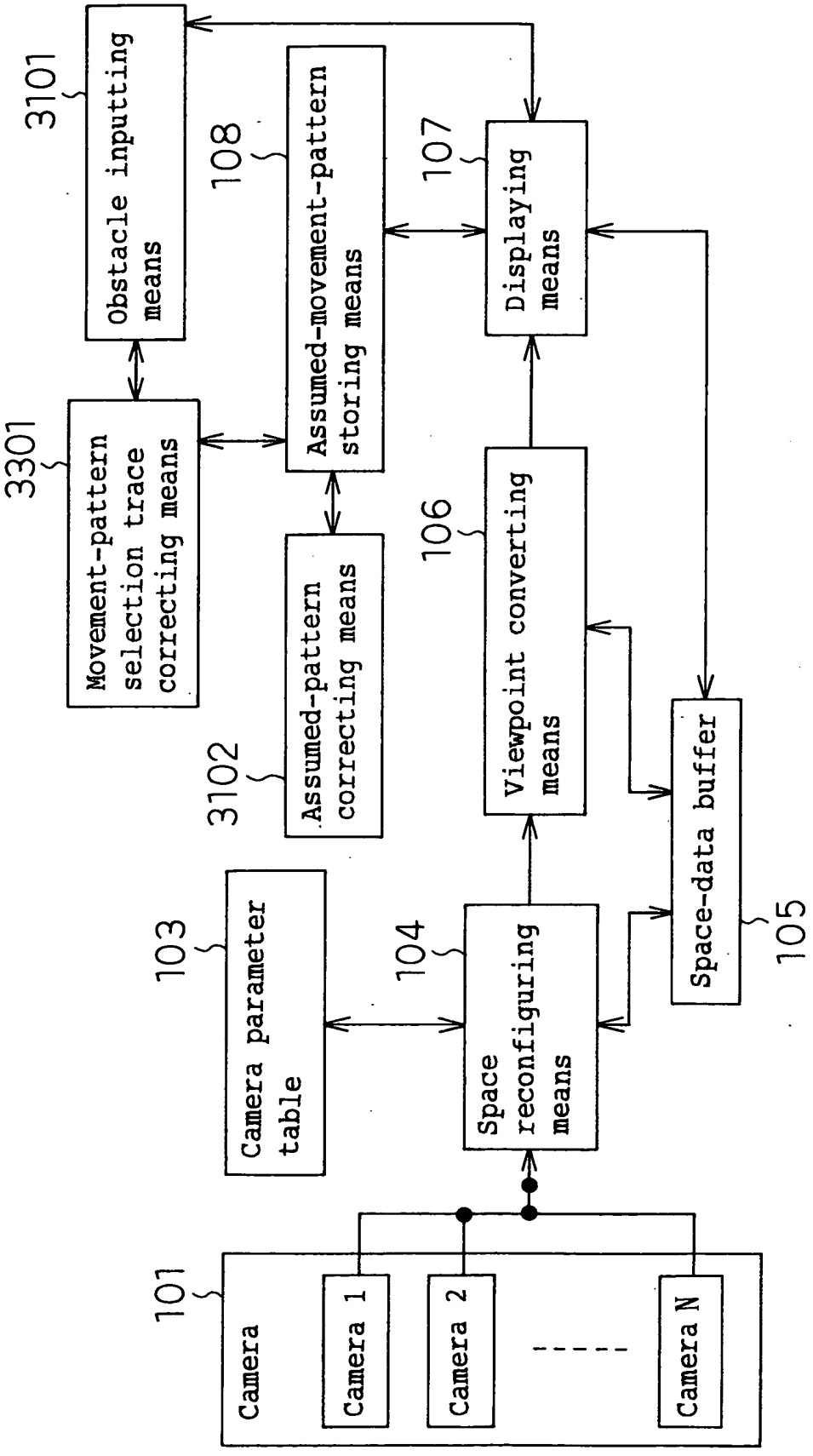

101
Camera
Camera 1
Camera 2
Camera N
103
Camera parameter table
104
Space reconfiguring means
105
Space-data buffer
106
Viewpoint converting means
107
Displaying means
108
Assumed-movement-pattern storing means
3101
Obstacle inputting means
3301
Movement-pattern selection trace correcting means
3102
Assumed-pattern correcting means

Fig. 44

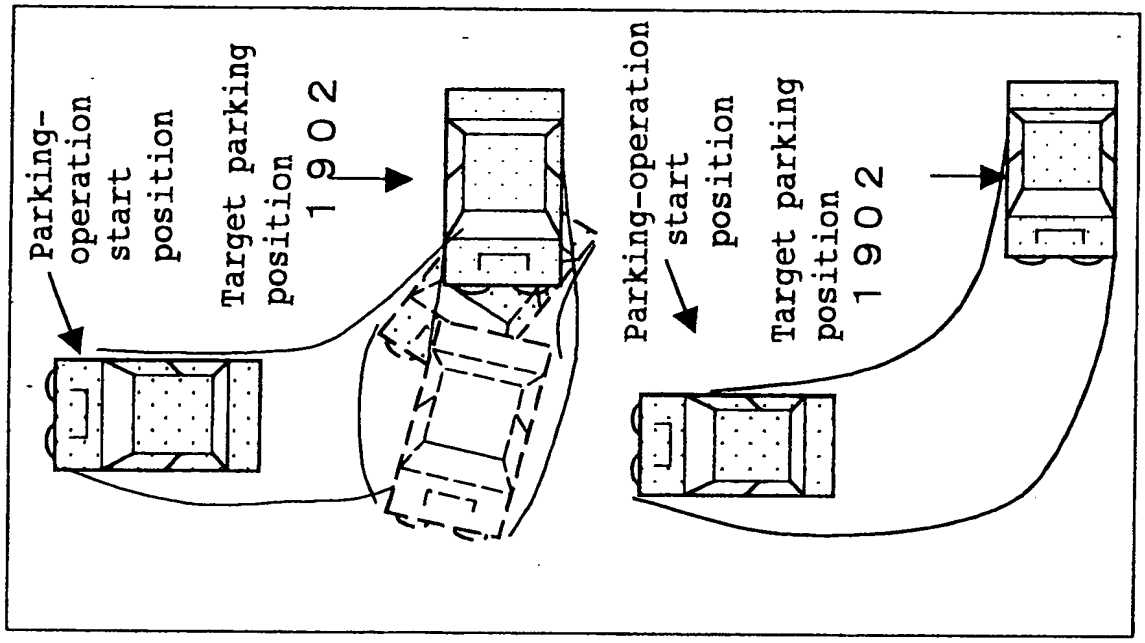

Parking-operation start position
Target parking position 1902
Parking-operation start position
Target parking position 1902

Fig. 43

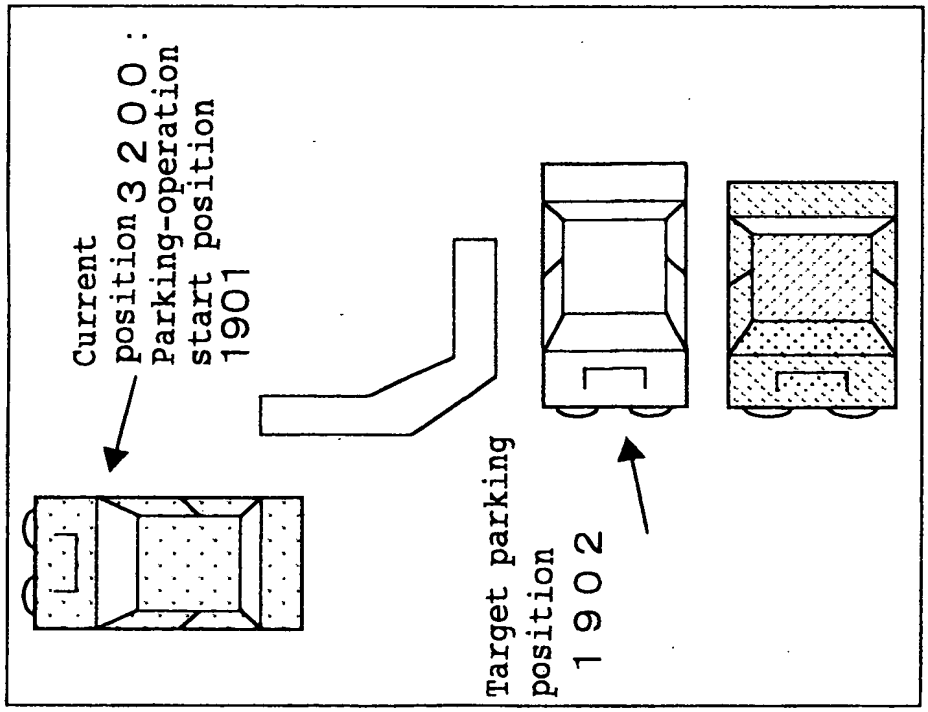

Current position 3200 : Parking-operation start position 1901
Target parking position 1902

Fig. 45

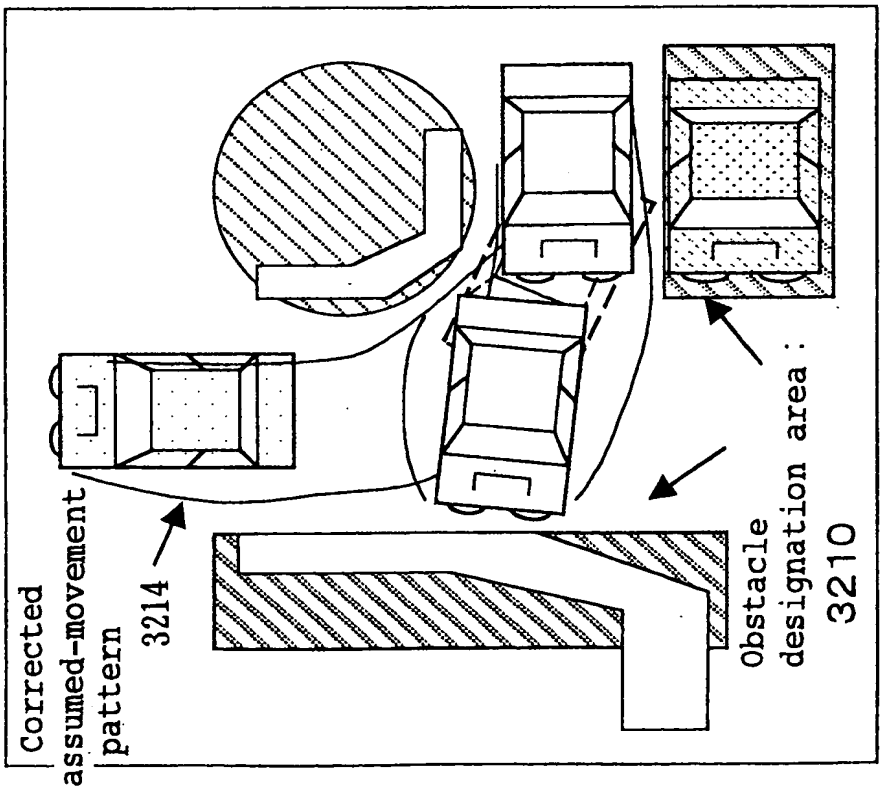
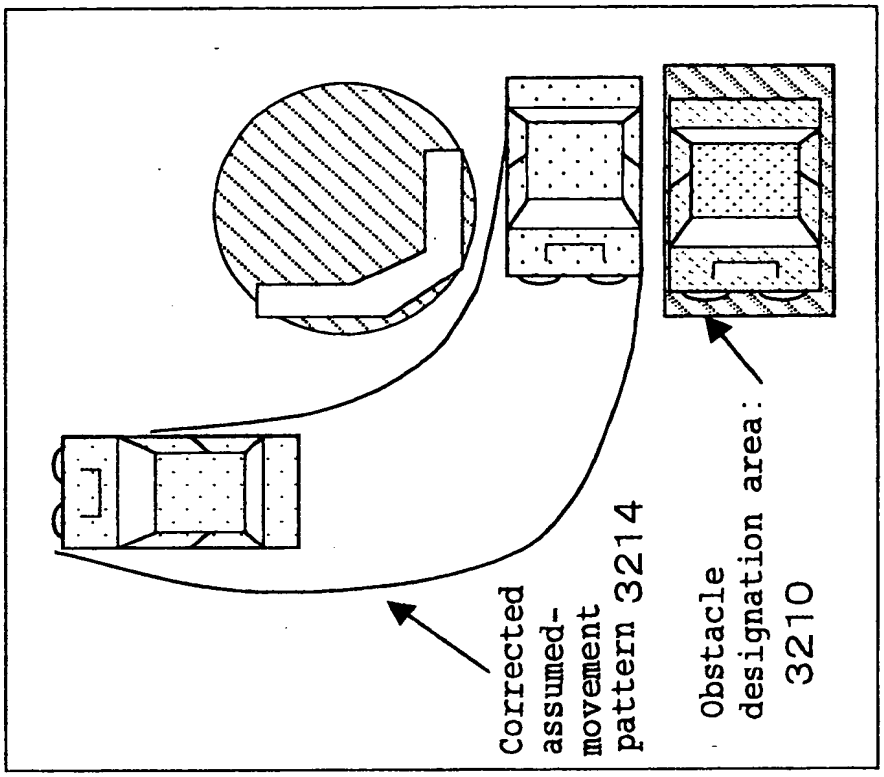

Corrected assumed-movement pattern
3214
Obstacle designation area :
3210

Fig. 46


Corrected assumed-movement pattern 3214
Obstacle designation area :
3210